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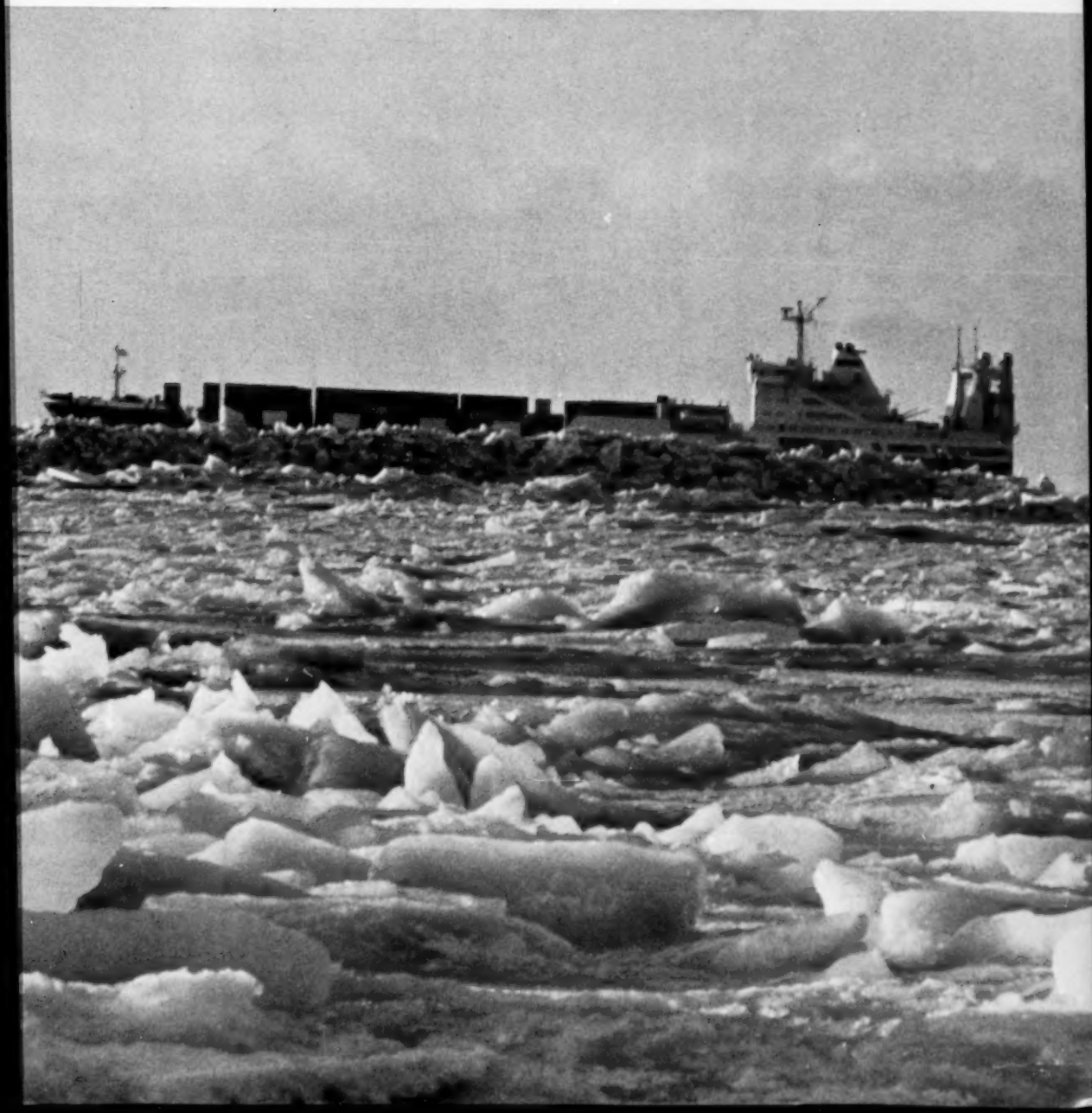

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Cover: Chesapeake ice during winter 1976-77. Rafted ice along the shipping channel blocks the view of container ship's hull off Tolchester, Md. Photo courtesy of Cris Bothe, Kent County News.

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Mariners Weather Log

ICEBREAKING PROCEDURES ON THE UPPER CHESAPEAKE BAY

Henry W. Gamp
Tug DRUM POINT
Curtis Bay Towing Company
Baltimore, Md.

Note: This article was originally published in Proceedings of the Marine Safety Council. It is reprinted with the kind permission of the author, who supplied some of the photographs, and the U.S. Coast Guard.

Because of the heavy ice conditions in the Upper Chesapeake Bay during cold winters (fig. 1) and the resultant stoppage or slowing down of oceangoing vessels and barge tows encountering this ice, a few observations on how ice jams vessels and how they are freed by icebreaking tugboats (fig. 2) may be useful to anyone unfamiliar with icebreaking procedures.

Ice truly is a unique and interesting phenomenon. Several degrees in temperature determine whether ice will form at all, or if enough ice will freeze to stop oceangoing vessels. Ice may be very hard one day because of low temperatures, weaken and begin thawing with a warming temperature, and regain its strength or hardness with a falling thermometer. Ice

Figure 1.--Three tugboats pull as a fourth one pushes a barge through the ice-covered Chesapeake Bay near Kent Island. These conditions were produced by a cold spell during the first two weeks of 1981. Wide World Photo.

Figure 2.--The Curtis Bay Towing Company tug DRUM POINT waits to assist vessels bound to or from the Port of Baltimore. The tug helps the Maryland Port Authority by keeping the shipping lanes open during cold winters when ice impedes navigation.

which is broken and soft may be pressed and compacted together, becoming thicker and harder than it was originally.

Large fields of ice may slide underneath other fields of ice, becoming twice as thick as the original ice. The open water left will cover with skim ice and will be only fractionally as strong as the older ice now knitted together. The weight of clinging ice may lay buoys on their sides or sink them. Ice freezing around small piers, pilings, day beacons, and radar ranges on low water can lift and destroy them with the rising tide. Small vessels which are grounded are at the mercy of the floes and run the risk of being capsized by the tremendous pressures exerted against their hulls.

Ice conditions are in no way uniform. They can remain constant or change quite rapidly. When there is slack water and no wind there is no motive force to affect the ice field and give it motion. Irregular shoreline, islands, jetties, and lighthouses act to anchor the surrounding ice when the forces of nature would otherwise be shifting it. This stationary ice is referred to as fast ice. Without some external force holding the ice field it is free to follow the wind and tide. Free-moving ice is known as pack ice. Pack ice being carried along by the wind and tide in open water can come in contact with fast ice and slide under this stationary field, forming ice twice as thick. Care must be used when following a path through pack ice made by another vessel or tow or when breaking a path for a vessel astern to follow, as the broken path may almost immediately be carried outside the channel limits.

Many misconceptions are held by the inexperienced on how vessels are affected by ice. It would seem logical to say, for example, that if a vessel is jammed in the ice, breaking a path in front of her should free her. However, this usually is not the case because the sharp bow acts as a wedge being driven into the ice. This ice must have a place to move to or it will exert pressure on the hull. If the force thus developed on the hull is equal to or greater than the propelling force which is driving the vessel ahead, she will stop. If the ice flows away from the ship and does not compress to the point of equalizing the propelling power of the ship, she will continue moving. The greatest resistance for an ice-encircled vessel pushing her way through the ice is where she turns at the bow (the widest part of the wedge). The least resistance she has is aft of the midbody, where the ice will more easily follow the narrowing quarter. The thrust from the wake stream also acts to relieve pressure on the stern and carry away ice.

Sheer power, though important, is not the only factor in breaking through ice; good hull design is essential. For example: ships with more cutaway bows, shorter midsections and cutaway quarters will enter ice and clear it easier than wide-beam blunt bulkcarriers. Some foreign vessels are built with icebreaking bows which allow the ship to ride up on the ice and break it. Ships designed for Scandinavian waters are often fitted in this manner.

Likewise, hull design of tugs will make a great deal of difference in the way they will perform in ice. Tugs which can be ballasted to keep the bow high and stern deep will do better than tugs trimmed down by the bow. This allows the tug to ride up on the ice in the manner of icebreakers; in addition, the weight of the tug helps break the ice and keeps the screw deeper in the water, affording it more protection from ice damage. Some tugs must be trimmed down at the bow to keep slush ice from following the hull down to the sea suctions and entering sea chests, thereby clogging them and making it necessary to shut down the main engine and remove the ice.

Tugs with keel coolers are superior to tugs not so equipped, provided the keel coolers are substantially constructed, because they have no sea suctions and strainers to clog up with slush ice. The necessity of shutting down the plant, often with the tug in a precarious position (i.e., when breaking a path in front of a vessel or tow when the assisted vessel is making way and is rapidly overtaking the stopped icebreaker) is eliminated. Tugs with elliptical sterns can turn better in heavy ice than tugs with square sterns because the fullness of the stern tends to jam the ice against it while turning, and a longer turning radius must be allowed for.

Weight is a factor in a vessel continuing to move through an ice field or slowing down and becoming jammed. Deep-loaded vessels and tows of the same horsepower as light-draft vessels and tows will continue moving in ice when the latter becomes bogged down and stopped. As it takes more power to move

a heavier vessel through the water, it also takes more resistance (ice) to stop her, and this is where weight and draft are advantageous to navigating in ice. Also, the deeper the draft, the deeper sea suctions and the less surface slush and chunk ice which will be drawn into the strainers.

The prudent navigator piloting his vessel in ice-congested waters will have to be attentive to the many dangers and hazards that can beset him. Ice fields drift with the wind and tide and very often are moving at oblique angles in relation to the vessel's heading, and at much higher velocities than the navigator is anticipating. Such an area is the eastern extension of Brewertown Channel. The channel is roughly east-west, while the tide sets in a generally north-south direction. The best aids to navigation in such an area are range lights, when visibility permits their use. The course made good and compass heading may be striking in their variance. When visibility is restricted, knowledge of which way the ice is setting and careful watching of the fathometer is the best method of keeping the vessel within the channel. Radar ranges to the shore or fixed aids such as lighthouses and also radar bearings to these objects are very useful. Where definite improved channels do not exist these radar ranges and bearings afford the navigator his best information, as the fathometer may not show a steep shoal until the vessel has grounded on it. Likewise, anytime the water shoals up unexpectedly the vessel should be stopped and her position fixed and adequate adjustments made on her course to prevent grounding. Tugboats transiting ice-congested areas cannot rely on making the course steered. The tug will sheer in the direction of least resistance, which can be a crack in the ice, thinner ice next to a heavy ridge of ice, and so forth. Also, the tug is often handled in such a manner as to take advantage of these factors in avoiding the hardest ice. Add to this the added deviation introduced into the magnetic compass by the tug pounding in the ice and variations of as much as 10 degrees from the normal variation in the Upper Chesapeake Bay, and the compass becomes a questionable instrument to be continually checked against more reliable information. A gyrocompass unaffected by these factors is far superior to the magnetic compass and every icebreaking vessel should be equipped with one.

The warning " The prudent navigator will not rely on any one single aid to navigation, particularly on floating aids" contained on all National Ocean Survey charts is especially appropriate when navigating in ice. Buoys are quite often missing, and even when they are observed they are just as apt to be off station as on (fig. 3). They need only be off station a few hundred feet to mislead a navigator enough to ground his vessel. One area where this could happen is Craighill Angle and Upper Craighill Channel, along the easterly edge of the channel, where the depth at places abruptly rises to 16 feet at the channel limits. Their positions should be

Figure 3.--On January 28, 1977, the combined pressure of 12 in of ice and strong winds tilted the Sharp Island lighthouse off its foundations.

verified by ranges and depth sounding.

Buoys can be unreliable and impossible to use at times. A buoy may show one minute and the next minute be dragged under the ice, or vice versa. Lights on buoys are often extinguished during ice season. Buoys constantly being dragged under the ice may have their light cages torn off, their bulbs may be burned out, and their batteries dead. Due to the increased workload placed on the Coast Guard at this time of year, buoy lights may remain extinguished for extended periods of time.

Chunks of ice often stick up high enough to be mistaken for buoys on the radar. At times these growlers appear to be ice-covered buoys even to the naked eye.

Numbers on buoys may not agree with their location. Sometimes a new coat of paint will be worn off a buoy by its constant grating against the ice, exposing the number of a former station where the buoy was previously placed. Occasionally a lighted red buoy which was formerly black, or vice versa, has been weathered to the point that the mariner is in doubt as to whether the buoy he is observing is red, black, or red and black. Buoys with 2-digit numbers may have one number erased; e.g., 18 may show as 1 or perhaps 8 instead of 18. In summary, be suspicious of floating aids, navigate by ranges, lighthouses, and fixed objects whenever possible, take your time, and try to establish your position and course by as many independent methods as are available to you.

Navigating in ice is serious and involves real risks. Avoid short cuts and possible shoals which more often than not lie close to those short cuts. If smaller vessels have a choice of more than one channel, route or fairway to follow they should take the deepest and best-marked of the alternatives. The ship channels are the best routes to follow because the volume of traffic using these routes helps keep them open. Often, channels are very passable, but only a couple hundred feet outside the channel limits heavy unbroken ice is impassable, or at best navigable with much difficulty. Sometimes the constant ship traffic within a channel during a warm period will entirely free the channel of ice, but on either side heavy ice will remain, giving the appearance of navigating within a canal. A vessel may encounter heavy ice all along a channel, turn on a reciprocal heading, retrace her track, and find almost no ice or ice of completely different thickness and texture.

If you do become stuck, a ship running close abeam at full speed may be the added boost you need to start moving again. An even more important reason to stay in deep channels is that a rescue vessel may not be able to take a short cut and you may be without aid. A vessel drawing 10 feet bound for Baltimore from the C&D Canal may feel she can avoid heavy ice at Tolchester by taking Pools Island Flats, but if she misjudges and becomes icebound, she is in serious trouble. Not only is she stuck where other vessels may not be able to reach her, but if she is pushed over a shoal--and there are many shoals on each side of the flats--she is in peril of being capsized. Take into account your limitations as well as those of your vessel. These types of risks certainly do not justify any savings in time. Do not permit your enthusiasm to outweigh obvious danger; allow margin for error.

As you approach an icebound vessel try to get an idea on which side the ice is heaviest; how the ship lays in relation to the channel; the course to be made good once the vessel is freed; and prepare a general plan of action, as you will be quite busy once you begin breaking ice around the vessel and all your concentration will be needed for your boat handling. Approach the vessel on whichever side appears to have the weakest ice; this is something in which experience will help greatly. Different types of ice may be weakest at different times of the day or night (fig. 4).

Figure 4.--Ship proceeding stern first in ice-clogged waters. Notice the ice build up between the ship and tug prevents the tug from laying alongside.

If another vessel has successfully traversed the channel by your stranded vessel in the not-too-distant past, this would be the side on which to make your initial pass. However, if it has been quite some time, say an hour or more since a vessel has passed by, this may not be the side to begin with. The ice may have compacted more and if it has had enough time to refreeze may, in fact, be stronger than the unbroken ice next to it. Constant breaking and refreezing can make very heavy and strong ice. Ice quite passable in daylight hours, because of sunlight and warmer temperatures, becomes tremendously hard after the sun sets as it compacts and freezes solid. The virgin ice next to it which was the more difficult to break during the day is now the easier to maneuver through.

Having decided on which side you will make your first pass, call the pilot of the vessel on your radio.

Tell him which side you propose to come down and instruct him to work the ship full ahead when you arrive abeam to take advantage of any pressure against his hull you might release. In the meantime, he can also help by shifting his rudder from hard right to hard left and so forth, allowing the ship to swing to the maximum arc the ice will permit each time. He can also have the master trim the vessel as deep aft as possible and as light forward as practical, and perhaps shift ballast side to side if it can be easily accomplished. Make passes up and down the side of the ship until the ice is broken.

A systematic routine of running a pattern up and down and ahead of the vessel is required. As you run circles around the vessel the tug will move easier the second, third, fourth pass, etc. Rather than make erratic passes, say 100 ft apart once you have initially broken the ice, move over 20 to 30 ft and expand the path you already have. This way you are not continually breaking hard ice, but instead slicing off a small ledge and allowing the tug to run freer.

When running toward the ship's bow run out some distance ahead so that if the vessel begins moving she will have broken ice ahead of her to follow. When you reverse your course, do a Williamson Turn; that way you will be heading more directly for the stranded vessel, as your tug will not make the sharp turn you are accustomed to her making in ice-free water.

When making your passes downa ship's side, it is not necessary to run as close as possible to her; in fact, it can be quite dangerous to do so. Fifty feet off is a good minimum distance. If the ice suddenly cracks toward the ship you will have enough time to throw your rudder away from her or stop your tug before she follows the crack to the ship and strikes her. As you run up and down along the vessel's hull you may be stopped where the midbody ends and the bow begins to cut away. The force of the vessel working full ahead against the ice creates a greater pressure at this point than at the other parts of the ship's hull. When this occurs, throw you rudder side to side to rock the tug. If she remains stuck, you must back up your tug (be sure to have rudder amidship), get a running start, and batter your way through the ice jam. When this fails, the ship must stop working ahead to release the pressure she is transmitting to the tug via the ice until the tug breaks out of the ice jam.

Generally, breaking ice in this manner around a ship will free her. One word of caution: if the vessel does begin to move, do not break a path directly in front of her, since if the tug becomes stuck or your plant overheats you will have no place to go. Pilots who have been stuck in ice are anxious to get underway again, and are reluctant to stop when they are moving simply because you are out ahead of them. It is far safer to run out ahead but off to one side or the other. You will be relieving the pressure and if you should stop, the ship can sail by you without anyone having a heart attack, collision, or scare. If the vessel is making better time than you once she is moving, follow astern in her broken water--but not so close that if she stops you can't avoid hitting her.

In the event the above procedures do not free the vessel, have the vessel stop her engines. Break up the ice in front of her, have the vessel back up some distance, then have the vessel come full ahead. Often, the momentum of the ship will be sufficient to keep her moving. The ice field may have been heavier at this point than the surrounding ice and once past it your ship will pick up some speed and keep moving. If she stops, repeat these maneuvers again and so on. More probably than not you will make some headway, be stopped by the ice, and have to start all over again.

Figure 5.--A closeup view of rafted Bay ice.

Once you are moving again let the pilot know if the ice is weakest on his port or starboard side. He will have a tendency to stay on the centerline of the channel no matter what. However, this is the time to move side to side in the channel and take advantage of any open or thin spots, as long as you can keep adequate water under your keel and are not meeting, crossing, or overtaking other vessels. If another vessel with more horsepower has recently passed by, fall into her track as long as it hasn't been carried outside the channel. Whenever possible, avoid that 4- to 5-ft-deep ridge where the pack ice has been hummocked and piled up against the fast ice (fig. 5).

Generally speaking, the methods employed to free ships locked in ice-clogged waters apply equally well for extricating barge tows. A tow is comprised of one or two tugboats pushing or pulling one or more barges. Therefore, it is necessary to point out how this and other diversities will alter the plan of action when breaking out ice-bound tows, as opposed to ships. For the purpose of this discussion a tow will be composed of one towing vessel and one barge.

Most tugboats operating in the Chesapeake Bay have a power range of 700 to 4,000 horsepower (hp) (fig. 6). Ships, on the other hand, range from a low of around 4,000 hp to upwards of 60,000 hp. From this it is easy to see that the lower powered tugboat which, in addition to itself, is towing a barge perhaps 300 ft long and 40 to 60 ft wide, will jam in much less severe ice conditions than most ships.

The draft of most tugboats and their tows rarely exceeds 16 ft. Ships may draw from 15 ft upward to 40 ft. This enables tows to navigate outside the improved channels in many instances. Consequently, they can take advantage of thin ice cover or perhaps clear water, where a ship constrained by her deeper draft could not do so. However, this lighter draft is a hindrance in heavy ice as the deeper laden the vessel, the more apt she is to continue moving.

A ship has a pointed bow which it drives into the ice, cutting it as a knife and allowing the ice to flow down along the vessel's hull. A barge, on the other

Figure 6.--DRUM POINT laying to in ice from 1 to 2-1/2 in thick. The author was able to walk out on the ice without danger of falling through. At times, even with 2,400 hp, the DRUM POINT was stopped by such thick concentrations of ice.

hand, has a square blunt bow which does not enter ice well at all. The barge being pulled or driven into the ice field pushes another field of ice before her as it cannot escape down her sides.

Barges towed in ice should be either pulled on a hawser or pushed ahead using wire pushing cables. Towing with the barge alongside has numerous drawbacks and should be avoided. These include added drag, less rudder power, continual set on to whichever side the barge is made fast, and ice jamming between tug and tow.

Make passes around the tow, breaking up the ice in the same manner as to free ships. When you no longer are making acceptable progress begin breaking ice around the tow once more. Have the tugboat operator swing his unit from hard right to hard left to free the ice from the barge's sides. Have him back up and then come ahead full, repeating this over and over until he is making headway.

After the ice is broken and not offering your tug much resistance, position your tug ahead of and slightly off the port or starboard bow of the barge. Keep your tug in such a position that your wake just misses the barge's bow and flows down her side, washing with it some of the ice which the barge is carrying out ahead of her. If you begin to outdistance the barge you must slow down or stop until the tow catches up to you. As long as headway can be made in this manner continue to do so. Keep a constant check on the barge behind you so you are not run over. Another thing to keep in mind is that your boat will need some time to pick up headway after slowing or stopping and the tow already has headway. Therefore, anytime you stop place your throttle back into idle. The ice will act as a brake and, importantly for you, it won't be necessary to wait precious seconds for your clutch to engage while the barge is overriding your stern.

The other method to use when towing in ice is to put a hawser on the tow and pull it (fig. 7). A wire bridle leading from both corners of the barge shackled to the tug's hawser would be the proper towing gear to use. The towing vessel will have an area of clear water from 20 to 100 ft astern, depending on the thickness of the ice. The hawser length should not exceed this area of free water, as this wash helps to disperse the ice forward of the barge. It must be borne in mind that if the tug stops the tow can override the tug, ramming her in the stern. Usually, when the ice is heavy enough to stop the tug it likewise stops the barge. Nevertheless, deep loaded barges have been known to come up on their tugs before. If you find yourself in this predicament work ahead full, throwing your rudder side to side to free yourself, and hope your wash hitting the barge will stop or deflect her.

The towing vessel can help herself by see-sawing from one side to the other, allowing the barge to pivot, and thus help free the ice from the barge's sides and allowing her wash to shove some of the ice out from the bow

Figure 7.--The tug ESTER K. is maneuvering into position to put her hawser on the N.B.C. line barge CONTAINER TRANSPORT No. 5 (barge is a converted L.S.T.). When her hawser is up, the tug MARTHA M. will come alongside her, passing her haswer over to the ESTER K.'s stem head and both tugs will pull the barge. The DRUM POINT will break a path for the tow to follow along Craighill Channel.

of the barge.

When ice conditions become severe it is desirable to form convoys for barge tows bound from Baltimore through the C&D Canal and from the canal to Baltimore and other Bay ports. This allows the Coast Guard and other privately operated icebreaking services to pool their men and equipment to effectively keep traffic moving, and not run helter-skelter around the Bay to free a dozen ice locked tows in a dozen different locations.

The usual procedure is to have an eastbound convoy leave Baltimore on the first day. Convoys are formed up at North Point or Swan Point and escorted through the C&D Canal to Reedy Point. Here the convoy disperses and the escorting vessels lay over for the night. The following morning they organize a westbound convoy bound for Baltimore. This convoy usually will form off Pea Patch Island then enter the C&D Canal. When conditions permit, the convoy will disband upon reaching North Point. Sometimes, tows will be escorted to the Francis Scott Key Bridge. Convoys will transit in this manner one day east, next day west until the Captain of the Port feels the need no longer exists. The nightly layover in port is quite essential for the crews of all vessels involved in icebreaking, as they are afforded very little sleep during the day with the tug bouncing, crunching and ramming the ice.

The convoy is organized with the most powerful tugs and their tows placed first in line in order of horsepower down to the smallest tug and tow last. Tugs with less than 1,000 hp are barred from these convoys as they are to underpowered to run in ice. If the lower powered tows were to lead the convoy, every time they stopped all progress would be halted until they were freed. However, by being astern of higher powered tows, the ice is broken when they reach it. If they stop in spite of this, one or two icebreaking vessels can assist the jammed tows while the rest of the convoy sails on.

The escorting vessels essentially break ice and assist in the same ways previously stated for freeing individual tows (fig. 8).

Tows sailing in convoy usually are made up using pushing gear. They are lined up close together so the wash from the first tow helps clear the ice from the second barge's bow, etc. down to the last tow. By keeping the tows close together, often it will be necessary to break ice only for the lead tow. Under severe conditions tugs may put out intermediate hawsers to the barge astern of them and one or more icebreakers may put hawsers on the lead barge, adding their horsepower to the convoy. This last method is very useful if one or two tows must continually stop when the rest of the convoy is able to keep moving.

In cases where an icebreaker assists a towing ves-

Figure 8.--The Coast Guard cutter APPALACHEE struggles to get its convoy of tugs and barges moving again. It took more than 24 hr to cover 32 mi. Wide World Photo.

sel by putting out a hawser on the aided vessel's stemhead, stay out in front of her. If you work off to one side you have the leverage to lay her on her side, especially so if her tow astern sheers in your direction. Watch astern of your vessel as well as ahead; its not a comfortable position for the one caught in the middle when the lead tug meanders all over the Bay.

Do not divide the convoy if the lead vessels are doing well, or one of two things may happen. Either the lead vessels will continue doing well, and when they reach their destination the slower group will call you back to aid them--so you retrace your track and begin again, or both groups stop and the icebreaking capability is now divided in half. Don't divide your resources--have the tows put out hawsers between them.

Good radio communications are essential to coordinate everyone's efforts. Often it may not be apparent to other vessels what each icebreaker is attempting to accomplish or what ice conditions are on the perimeter of the convoy's track. Radios also allow you to tell everyone you are ice locked, need assistance, or shout "Watch out--I'm stuck, don't run me over!" If you see the convoy being set into shoal water you can alert the rest of the vessels. Therefore, keep your radio turned on and listen to it!

In summary, let me stress three things above all others. Do not allow yourself to be rushed. Icebreaking is slow, methodical and tedious work. Allow yourself margin for error. It may save writing an accident report. Lastly, keep track of your position at all times! It is all to easy to become confused after making 20 or 30 circles around a stranded vessel.

I hope this information will be of assistance to anyone sent to break ice without having had previous experience. These are the procedures and principles that I have observed over the past several winters; they form the nucleus of knowledge from which I work. Quite possibly there are other methods just as good as these, perhaps better. Other captains or pilots may take exception to some points I have made. Nevertheless, this discussion should give the uninitiated some idea of what will be facing them and what should be done under various circumstances which they will encounter.

THE MARINERS WEATHER LOG WELCOMES ARTICLES AND LETTERS FROM MARINERS RELATING TO METEOROLOGY AND OCEANOGRAPHY, INCLUDING THEIR EFFECTS ON SHIP OPERATIONS.

Mariners Weather Log

NORTH ATLANTIC TROPICAL CYCLONES, 1980

Joseph M. Pelissier
and
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Miami, Fla.

Hurricane activity in the Atlantic began and ended late this year. Hurricane Allen formed on August 1 and hurricane Karl died on November 27. Records show that the median starting and ending dates for hurricane activity are June 26 and October 29, respectively. This was the first year since 1932 in which two hurricanes formed in November. During this century, Jeanne was the only November storm to strengthen into a hurricane in the Gulf of Mexico, and Karl was the only late November storm observed so far east in the Atlantic.

There were 11 named storms in 1980, 9 of which became hurricanes. This compares with the corresponding long-term averages of 10 and 6. The nine hurricanes resulted in a total of 38 hurricane-days; the average is 26. Eight of the hurricanes spent their entire lives at sea. Only Allen and tropical storms Danielle and Hermine made landfall. Allen accounted for the entire death toll of the season and all but a small fraction of the damage. Storm tracks and statistics are given in figure 9 and table 1, respectively. Tables 2 and 3 list tropical cyclones for past years.

Allen also proved to be the storm with the greatest impact on marine interests, judging by the number of reports received at the National Hurricane Center (table 4) from ships encountering gale-force winds. Not surprisingly, Allen, which was a hurricane for 14 days, accounted for 35 percent of the total of 192 such reports. However, Jeanne, which maintained hurricane strength for only 30 hr, accounted for 28 percent of the gale reports. Also, hurricanes in the Gulf of Mexico represented only 8 percent of the total hurricane-days, yet 52 percent of the gale reports were received from that area. This reflects, to some degree, the concentration of shipping in the Gulf of Mexico. Only one ship reported encountering hurricane-force winds in Allen compared to three in Jeanne and seven in Frances.

HURRICANE ALLEN - AUGUST 1-11

The first hurricane of the year proved to be the second strongest Atlantic hurricane on record in terms of its minimum central pressure. Only the famous "Labor Day Hurricane," which struck the Florida Keys in 1935 with a central pressure of 892 mb, had a lower pressure than the 899-mb measured by an Air Force reconnaissance flight in Allen on August 9.

Allen formed from a tropical wave which moved off the west coast of Africa on July 29. It became a tropical storm in the central Atlantic less than 100 mi from the location where disastrous hurricane David became a storm a year earlier. The two storms followed similar tracks across the ocean and into the eastern Caribbean Sea. However, Allen crossed the Lesser Antilles to the south of David's track, brushing the northern part of Barbados and raking the southern tip of St. Lucia. Winds reached 90 kn on St. Lucia, where the hurricane caused six deaths and damages amounting to $235 mil-

Table 1.--North Atlantic tropical cyclone statistics, 1980

Cyclone number	Name	Class[1]	Dates[2]	Maximum sustained wind (kn)	Lowest pressure (mb)	U.S. damage (millions of $)	Deaths
1	Allen	H	August 1-11	165	899	300	U.S. - 2; Caribbean - 234
2	Bonnie	H	August 14-19	85	975		
3	Charley	H	August 20-25	70	989		
4	Danielle	T	September 4-7	50	1004	minor	
5	Earl	H	September 4-10	65	985		
6	Frances	H	September 6-20	100	960		
7	Georges	H	September 1-8	70	993		
8	Hermine	T	September 20-25	60	993		
9	Ivan	H	October 4-11	90	970		
10	Jeanne	H	November 8-16	85	986		
11	Karl	H	November 25-27	75	985		

[1]T - tropical storm (winds 34 - 63 kn)
H - hurricane (winds 64 kn or higher)

[2]Day starts at 0000 GMT

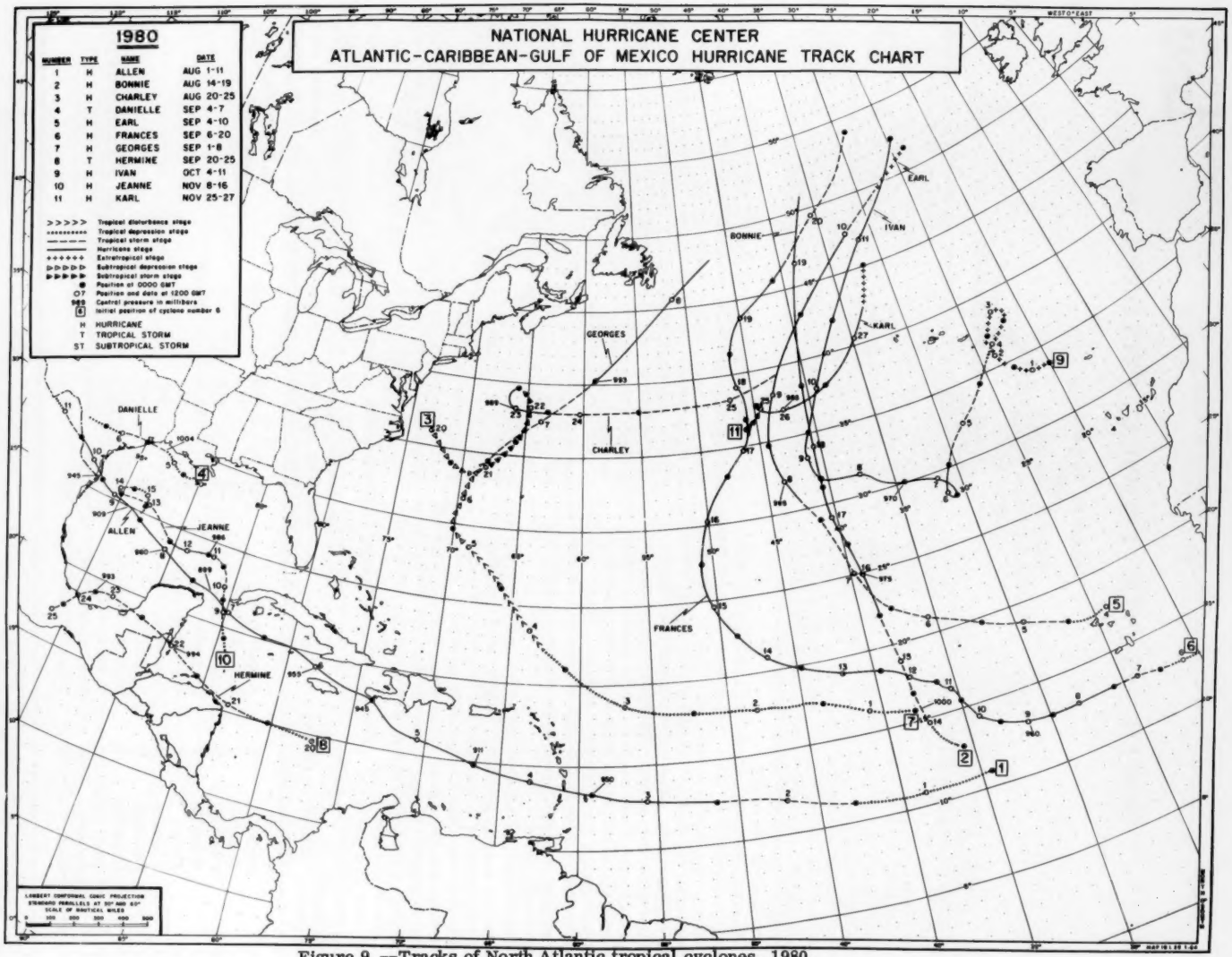


Figure 9.--Tracks of North Atlantic tropical cyclones, 1980.

Table 2
NORTH ATLANTIC TROPICAL CYCLONES FOR PAST YEARS

TOTAL NUMBER OF TROPICAL CYCLONES, LOSS OF LIFE AND DAMAGE								
Total Number Tropical Cyclones*		Total Number Hurricanes		Loss of Life		Damage by Categories**	
Year	All Areas	Reaching U.S. Coast	All Areas	Reaching U.S. Coast	Total All Areas	United States	Total All Areas	United States
1931	9	2	2	0		0		0
1932	11	2	6	2		0		0
1933	21	7	9	5		63		7
1934	11	5	6	3		17		5
1935	6	2	3	2		414		7
	56	21	26	12				
1936	16	7	7	3		9		6
1937	9	4	3	0		0		0
1938	8	4	3	2		600		8
1939	8	3	3	1		2		2
1940	9	3	4	2		51		6
	46	21	20	8				
1941	6	4	4	2		10		7
1942	10	3	4	2	17	6	7	7
1943	10	4	8	3	19	16	7	7
1944	11	4	7	3	1,076	64	8	8
1945	11	3	5	3	29	7	8	8
	48	20	28	11				
1946	6	4	3	1	5	0	7	7
1947	9	7	5	3	72	53	8	8
1948	8	4	6	3	24	2	7	7
1949	13	3	7	2	4	4	8	8
1950	13	4	11	3	27	19	7	7
	50	22	32	12				
1951	10	1	5	0	244	0	7	6
1952	7	2	6	1	16	2	6	6
1953	14	6	6	2	3	2	7	7
1954	11	4	8	3	720+	193	9	9
1955	12	5	9	3	1,518+	318	9	9
	54	18	37	9				
1956	8	2	4	1	76	21	8	7
1957	8	3	3	1	475	395	6	8
1958	10	1	7	0	49	2	7	7
1959	11	7	7	3	57	24	7	7
1960	7	5	4	2	105	65	8	8
	44	20	25	7				
1961	11	3	6	1	345	46	8	8
1962	5	1	3	0	4	4	6	7
1963	9	1	7	1	7,216+	11	9	7
1964	12	6	6	4	208	49	9	9
1965	6	2	4	1	76	75	9	9
	43	13	26	7				
1966	11	2	7	2	1,040	34	6	7
1967	9	2	5	1	60	15	8	8
1968	8	3	3	1	11	9	7	7
1969	16	3	12	2	264	256	9	9
1970	10	3	5	1	74	11	9	6
	54	13	35	7				
1971	13	5	6	3	44	8	8	8
1972	7	3	3	1	126	121	9	9
1973	8	1	4	0	16	5	7	7
1974	11	2	4	1	5,000+	1	8	8
1975	9	1	6	1	60	21	9	9
	48	12	23	6				
1976	10	4	6	1	77	3	8	8
1977	6	1	5	1	10	0	7	7
1978	12	3	5	0	41	35	7	7
1979	9	5	5	3	1,285	22	9	9
1980	11	2	9	1	226	2	9	8
Total	494	174	283	85				
Mean	9.9	3.5	5.7	1.7				

**The Environmental Data Service has for some time recognized that, without detailed expert appraisal of damage, all figures published are merely approximations. Place errors in dollar estimates vary in proportion of the total damage, storms are placed in categories varying from 1 to 9 as follows:

1 Less than $50
2 $50 to $500
3 $500 to $5,000
4 $5,000 to $50,000
5 $50,000 to $500,000
6 $500,000 to $5,000,000
7 $5,000,000 to $50,000,000
8 $50,000,000 to $500,000,000
9 $500,000,000 to $5,000,000,000

* Including hurricanes and after 1967 subtropical cyclones
0 Not reported in literature, believed minor.
+ Additional deaths for which figures are not available.

lion.

Crossing the northern Caribbean Sea, the eye of the hurricane struck a glancing blow on Haiti, then skirted Jamaica, the Cayman Islands, and the Yucatan Peninsula (fig. 10). Haiti was the hardest hit, with a reported death toll of 220, hundreds of thousands homeless, and hundreds of millions of dollars in damage.

As Allen traversed the Caribbean Sea, reports were received that the GEORGIOS G., a Panamanian ship enroute from Santo Domingo to Belize with 27 persons aboard, was lost in the storm. A Coast Guard search found an inflated liferaft with the ship's name about 100 mi south of Haiti. No further details are available, and possible fatalities from this incident are not included in the season totals.

Allen entered the Gulf of Mexico on August 7 and continued on a west-northwest course toward the lower Texas coast. During its entire history, Allen moved on a remarkably steady heading, deviating only slightly from a predominantly west-northwest course. However, in many cases these deviations were timely, sparing many locations from the full brunt of the hurricane's core. Thus, Jamaica, the Cayman Islands, Yucatan, and, to a lesser extent, Haiti all received damage but escaped the potential devastation that a direct hit might have caused. Upon approaching Texas, the eye of Allen jogged slightly to the north, crossing Padre Island and the mainland coast over a relatively undeveloped and thinly populated section (fig. 11). Nevertheless, Allen was severe enough to cause an estimated $300 million in damage and two deaths in Texas. Two offshore oil rigs in the Gulf of Mexico were destroyed (figs. 12 and 13). Thirteen persons died in a helicopter crash during the evacuation of an oil rig. There were at

Table 3
NORTH ATLANTIC TROPICAL CYCLONES FOR PAST YEARS

Frequency of Tropical Cyclones (including Hurricanes) by Months and Years											Frequency of Tropical Cyclones Reaching Hurricane Intensity by Months and Years										
		May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total		May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1931			1	1	2	3	1	1		9	1931				2					2
1932		1			2	3	3	1		11	1932				3	1	1			6
1933		1	1	2	7	5	3	1		21	1933		1	1	3	3	1			9
1934		1	1	1	2	2	3	1		11	1934		1	1	1	1	1	1		6
1935					2	1	2			6	1935				2	1	2			5
1936				3	2	6	4	1		16	1936			1	1	3	2			7
1937				1	2	6				9	1937					3				3
1938					2	1	3	1		8	1938					2	1			3
1939				1	1	1	2			5	1939					1		2		3
1940			1		3	2	2			8	1940					3	1			4
1941							4	2		6	1941						2	1		4
1942					2	2	2	1		10	1942					2			1	4
1943				1	2	4	3			10	1943				1	1	2	1		5
1944				2	2	4	2			11	1944				2	1	2	1		7
1945			1	1	4	3	2			11	1945			1		1	1	0		5
1946			1		1	1	1	2		6	1946				1		1	1		3
1947				1	2	3	3			9	1947					2	1	2		5
1948		1		1	2	3	1	1		9	1948					1	2	1	1	6
1949					2	7	2	1		13	1949					2	4	1		7
1950					1	4	3	6		13	1950					4	3	4		11
1951		1				3	4	2		10	1951	1				2	2	2		6
1952	(Feb.) 1					2	3	2		7	1952					2	2	2		6
1953		1				3	4	4	1	14	1953					2	3	1		6
1954				1	1	2	4	1	1	11	1954			1		2	2	1	1	6
1955				1	1	4	5	2		12	1955					3	3	1		9
1956				1	1	1	4	1		8	1956			1	1	1	1			4
1957				2		1	4	1		8	1957			1		2	2			3
1958				1		4	4	1		10	1958					3	3	1		7
1959			1	2	1	3	2			11	1959			1	2		3	1		7
1960				1	2	1	3			7	1960				1	1	2			4
1961					1		6	2	2	11	1961				1		3	1	1	6
1962						2	2	1		5	1962					1	1	1		3
1963				1		1	5	2		9	1963				1	1	4	1		7
1964			1	1	4	4	1	1		12	1964					2	3	1		6
1965			1		2	2	1			6	1965					2	1	1		4
1966				1	1	4	4	1		11	1966				1		3	1	1	6
1967					1	4	3			8	1967					1	2	1		4
1968			3		1	3	1			8	1968			2		1	1	1		5
1969				1	5	6	3	1		16	1969					4	4	2	1	11
1970		1			1	3	3	2		10	1970	1				1	1	2		5
1971					1	4	6	1	1	13	1971					2	4			6
1972		1	1		2	2	2		1	7	1972			1		1	1			3
1973				2	2	2	2			8	1973				1	1	1	1		4
1974			1	1	2	4	1			11	1974					2	2			4
1975			1	1	2	3	1		1	9	1975				1	2	3			6
1976		1			1	5	2	1		10	1976					4	1	1		6
1977					1	1	3	2		6	1977					1	3	1		5
1978	(Jan) 1			1	1	4	3	2		12	1978					2	2	1		5
1979			1	2	3	2	1			9	1979				1	2	2			5
1980					3	5	1	2		11	1980					3		1	2	6
Totals	(Jan) 1 (Feb) 1	11	27	41	127	171	93	19	3	494	Totals	2	11	10	33	100	49	9	1	223

Figure 10.--Allen pounds Santo Domingo. A gigantic wave crashes against the sea wall at the capital city of Santo Domingo. Wide World Photo.

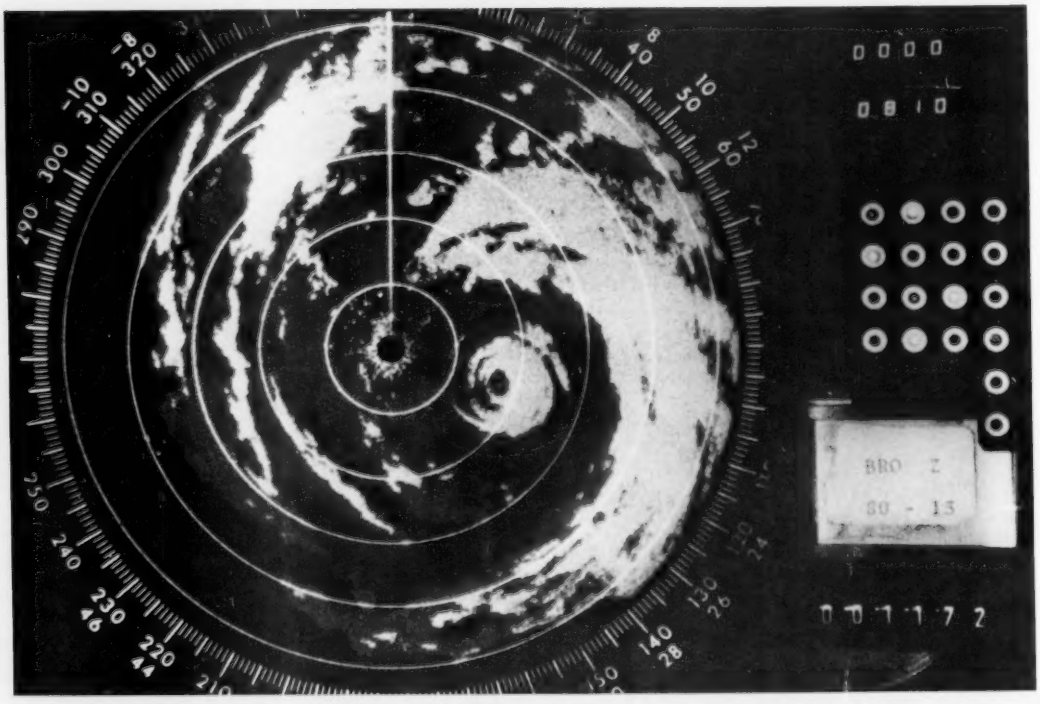


Figure 11.--Brownsville radar shows eye of Allen just off the lower Texas coast at 0000 August 10.

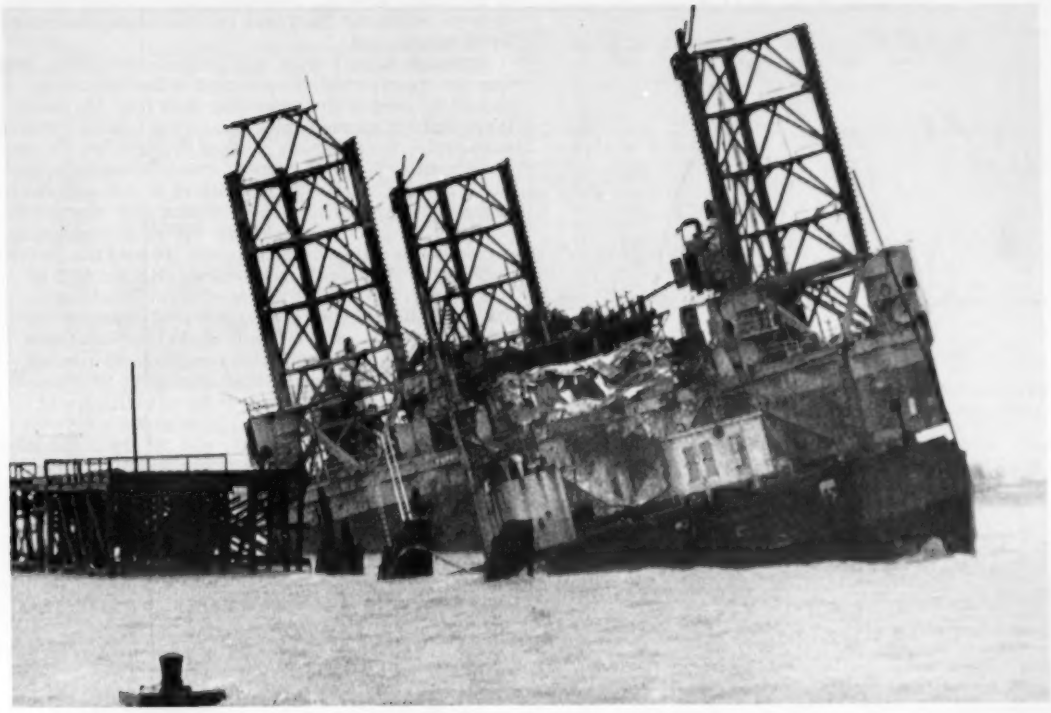


Figure 12.--A barge carrying an oil rig lists as it takes on water after being pounded by hurricane Allen. Wide World Photo.

Figure 13.--The Liberian tanker MARY ELLEN grounded 12 mi south of Port Aransas, Tex. The ship ran aground during hurricane Allen's high winds and seas. Wide World Photo.

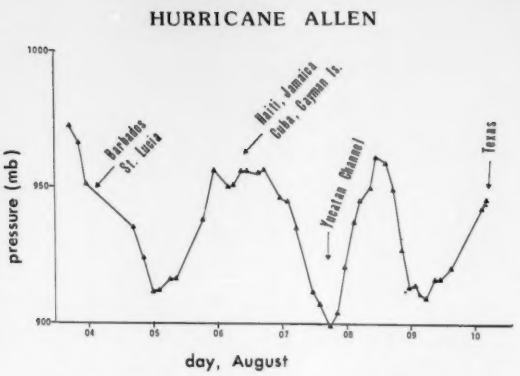


Figure 14.--Graph showing the time variation of central pressure in hurricane Allen.

least a dozen tornadoes in Texas and rainfall amounts up to 20 in deluged a swath across the southern part of the state (table 5). Approximately one-half million persons evacuated the Texas and Louisiana coasts as Allen approached.

Although Allen's track was remarkably steady, such was not the case with the strength of the hurricane. A plot of the central pressure with time (fig. 14) shows three distinct strengthening-weakening cycles. During each cycle, the pressure changed by about 50 mb, or 50 percent of the total range of observed central pressures in hurricanes. Such a pattern of intensity fluctuations is unprecedented in hurricane records, and is not well understood. During the second strengthening cycle, the pressure dropped to 899 mb as Allen passed through the Yucatan Channel and entered the Gulf of Mexico (fig. 15). After a rise of about 50 mb, the pressure plunged once more, this time reaching 909 mb--a minimum exceeded only three previous times in hurricanes, including Allen's earlier 899-mb low.

Allen got the 1980 hurricane season off to an awesome start, but did not prove to be an indication of things to come. No other hurricane of the year even came close to Allen's strength, nor did any of the subsequent hurricanes affect any land areas.

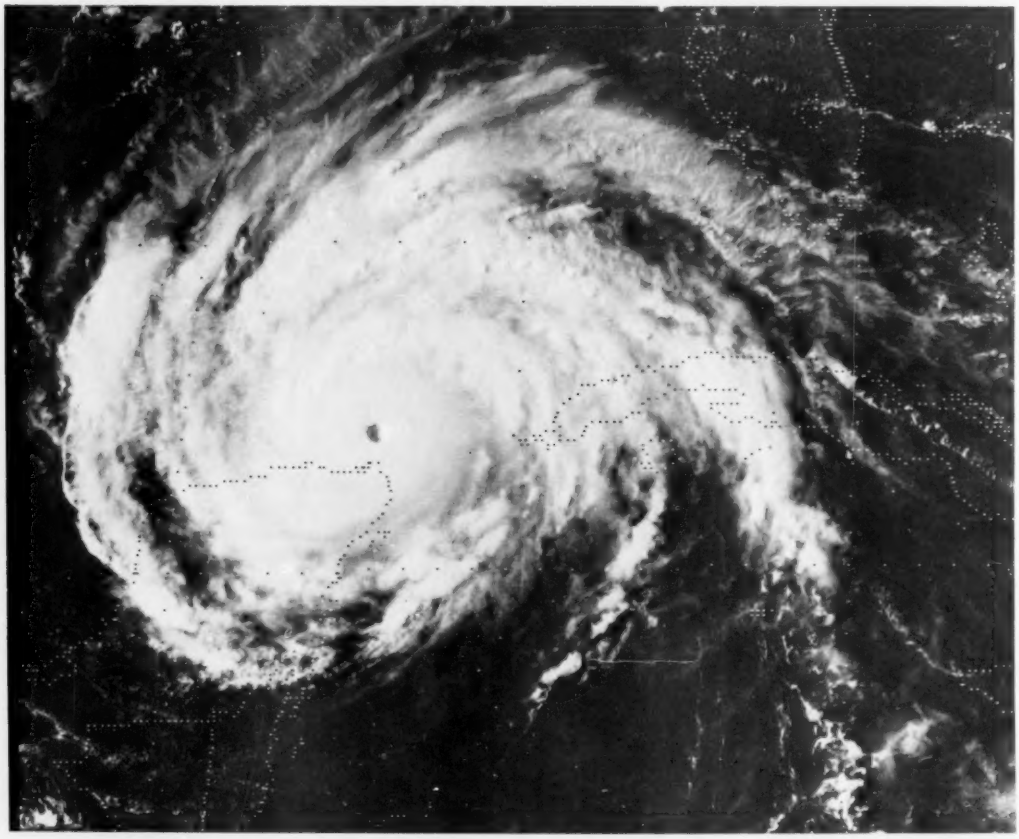


Figure 15.--Allen at peak intensity on August 7.

Table 4. -- Ships encountering tropical cyclones in the North Atlantic during 1980

Call	Vessel Name	Nationality	Date	Time GMT	Ship Position Lat. °N	Ship Position Long. °W	Wind Dir. 10°	Wind Speed (kn)	Pressure (mb)	Sea Waves Period (sec)	Sea Waves Height (m)	Sea Swells Dir. 10°	Sea Swells Period (sec)	Sea Swells Height (m)
ALLEN			AUG											
9VEF			03	00	15.2	50.0	11	35	1015.1	11	6		7	3
FNXB	FINA ANGOLA	France	03	21	16.0	56.9	09	35	1000.5	06	3	09	6	12
FNFE			04	09	12.2	61.9	08	40	1002.8	02	2			
FNFE			04	12	12.6	61.5	22	40	1005.2	05	3	99		2
FNFE			04	15	13.5	61.5	12	40	1009.1	05	4			
ECHW			04	21	18.2	68.1	05	40	1000.0					
FNEY	VIERGE MARIE		05	00	16.8	65.3	09	40	1007.5		6			
FNEY	VIERGE MARIE		05	03	16.3	65.2	11	40			7			
WVVX			05	03	13.5	69.6	33	35	1005.8	02	2	02	5	2
LNUP			05	03	19.1	69.0	03	35	1004.8	03	4			
ELPH	FAIRWIND		05	04	19.0	66.2	07	40	1012.0					
FNEY	VIERGE MARIE		05	09	14.0	66.0	12	40	1006.0					
WMBY			05	09	12.5	68.5	05	40		07	5	11	7	7
5MOZ	CHEVRON SOUTH AMERICA		05	12	14.5	67.5	15	45	1009.5	08	4			
ONCD	CHERTAL	Belgium	05	18	18.5	75.3	05	35	1008.1	02	1	06	5	3
KIYD			05	18	19.8	74.3	34	40	1012.5	99	3	07	7	3
FNFA	SOUFFLOT		05	18	13.7	68.8	12	35	1008.0	04	3	13		3
WMBK	MORMACSUN		05	18	17.5	69.3	12	40	1008.9	05	6	17	2	4
ONCD	CHERTAL	Belgium	05	21	17.5	75.5	04	35	1003.0	04	2	11	7	2
LCNX			06	00	17.0	75.8	35	50	1002.6	05	5			
ONCD	CHERTAL	Belgium	06	00	17.0	76.0	35	50	1002.6	03	5	09	5	5
JRBQ			06	00	19.4	74.3	04	60	1004.0	05	4	04	8	3
DICQ			06	12	16.6	75.0	14	45	1002.3	07	5	14	4	5
5LKL	DAVID P. REYNOLDS	American	06	18	19.7	83.9	36	35	1008.0	06	3	18	8	3
5LKL	DAVID P. REYNOLDS	American	07	00	19.4	82.2	36	40	996.0	03	2	30	6	2
LGAS	ADMIRAL NIGERIA		07	00	18.8	83.6	34	35	996.0		3			
GSUM	POST CHAMPION	British	07	00	20.1	84.7	01	35	1007.4	05	3	06	6	3
WOOP			07	00	24.5	81.0	05	40	1012.5	07	6	05	7	6
KUNZ			07	00	24.3	83.4	09	40	1013.0	03	3	09	5	3
DGEF			07	00	24.0	82.3	08	35	1013.0	06	5	08	6	5
GSUM	POST CHAMPION	British	07	00	19.4	84.4	32	35	1000.4	06	3	35	8	5
KIGR	KEYSTONER	American	07	09	23.2	86.0	09	45	1010.6	06		34	9	4
KIGR	KEYSTONER	American	07	12	23.2	85.6	05	35	1007.1	06	5	05	9	6
5LKL	DAVID P. REYNOLDS	American	07	12	18.6	80.6	14	35	1007.8	06	4	12	8	4
KIGR	KEYSTONER	American	07	18	23.3	85.5	09	55	1000.9	09	9			
GUDA	STRATH DEVON		07	18	25.1	85.2	08	35	1013.0					
EIZP			07	18	25.1	87.7	07	35	1011.3	02	2	09	8	5
GPEY	BARRANCA	American	07	21	24.5	86.3	08	35	1009.2	03	4	99	5	6
KTHC	TEXAS TRADER	American	07	21	24.5	83.0	11	35	1010.8	03	3			
5MHP	PHILLIPS TEXAS	American	07	23	24.3	85.8	09	60	1004.0	99	8	09	5	8
GPEY	BARRANCA	American	08	00	25.7	85.8	08	35	1010.3	03	4	09	6	6
VIGM			08	00	26.8	88.4	07	35	1011.2	03	1	10	5	2
ELJP	IRISH CEDAR	Irish	08	00	24.7	87.6	08	35	1006.4	02	2	09	7	5
5MHP	PHILLIPS TEXAS	American	08	02	24.5	87.0	10	60	1005.0	99	7	10	5	8
KIGL	SOCONY VACUUM	American	08	12	22.0	94.1	30	40	1005.1	02	2	09	8	1
PHKW	SEPIA	Netherlands	08	12	22.2	90.9	30	35	996.3	05	3	07	9	5
ELJP	IRISH CEDAR	Irish	08	12	24.6	85.4	13	35	1010.7	02	2	14	2	4
5MWW			08	14	27.1	87.0	09	40	1010.5					
	COLORADO	American	08	15	27.9	86.4	04	40	1011.2	05	3	12	9	5
DOYD			08	18	27.4	91.2	09	40	1009.5					
KGKV	TEXACO NEW YORK	American	08	18	27.4	90.3	09	40	1009.1	03	2	09	8	4
GRIS	CUNARD CARRIER		08	18	27.9	91.4	09	45	1000.9	01	5	10	6	6
GYLW			08	18	27.3	94.4	05	40	1008.7	04	3	11		
COLK	JUREL		08	18	27.6	91.4	08	45	1010.8	05	3	11	9	5
KAHA	ARCO-HERITAGE		08	21	27.5	91.2	08	35	1011.0	06	3	13	1	4
PHKW	SEPIA	Netherlands	08	21	26.3	90.1	27	35	999.9	04	4	99		5
KEOL			09	00	26.5	96.0	04	35	1007.5					
KEOL			09	03	26.0	96.4	35	45	1003.0	99	2	09	0	8
KFLF			09	03	26.5	96.0	04	40	1005.8	08	3	04	9	3
SHIP			09	06	27.5	91.2	11	50	1007.8	08	8	07	8	5
KFLF	MONMOUTH	American	09	09	27.9	95.3	07	40	1001.7	05	1	04	8	4
KEOL			09	12	24.1	95.8	30	75	998.2	99	4	99		8
KFLF	MONMOUTH	American	09	18	27.9	94.6	29	40	1003.0	05	3	99		4
PEWU			09	18	28.0	92.3	13	35	1002.0	05	5	99	1	5
KFLF	MONMOUTH	American	09	21	28.0	94.6	11	40	1002.4	09	2	10	8	4
KESC			09	21	24.5	94.0	16	40	998.5	99	8	99		99
KFLF	MONMOUTH	American	10	00	22.7	94.5	09	40	1002.0	04	2	10	8	4
BONNIE			AUG											
GYHC	RUDDBANK		14	1545	15.5	37.5		35	1003.2					
GYHC	RUDDBANK		14	17	15.5	37.3	17	35	999.9					
GYHC	RUDDBANK		14	18	15.7	36.0	19	45	1002.5	06	4	19	0	5
CHARLIE			AUG											
9VDR			22	12	38.0	64.5	06	60	999.5					
JBUY	TOZUI MARU	Japan	22	12	38.2	65.9	05	50	1005.5	04	4	05	8	5
9VDR	BINTANG KEJORA		22	12	38.0	64.6	06	50	999.5					
6ZHW	SPLENDID DIAMOND		22	18	38.3	61.5	13	40	1004.0					
UYCU	VYAZMA	Russian	22	18	39.9	67.5	04	35	1008.3	08	5			
ZBML			23	12	37.5	67.6	32	45	1003.5			35	6	6
PJKA	DILOMIA		23	12	39.2	69.0	36	40	1009.0	08	5	99		5
ZBML			24	00	37.1	64.4	26	45	991.8	04	3	27	8	4
LSDU			24	00	37.5	64.1	18	45	998.2					
OJCS			25	06	36.2	51.0	27	45	1008.0	03	3	25	5	3

TROPICAL STORM DANIELLE (NONE)

Call	Vessel Name	Nationality	Date	Time GMT	Ship Position Lat. °N	Ship Position Long. °W	Wind Dir. 10°	Wind Speed (kn)	Pressure (mb)	Sea Waves Period (sec)	Sea Waves Height (m)	Sea Swells Dir. 10°	Sea Swells Period (sec)	Sea Swells Height (m)
EARL			SEP											
UPGL	FRANTS BOGOUCH		7	18	28.8	41.0	10	35	1016.4			16		3
GPUR	GEESTLAND	British	8	00	29.3	39.1	14	35	1018.9	05	3			
ELMN	DRUCILLA U.		8	12	31.2	39.9	12	45	1019.0	06	3	12	7	4
H8WL			8	12	31.2	42.8	18	45	1014.5	05	3	18	5	3
JIAK	KINOKUNI MARU	Japan	8	18	31.1	42.6	15	35	1015.1	05	4	18	7	3
JIAK	KINOKUNI MARU	Japan	9	00	33.1	43.5	21	35	1015.3	05	3	18	7	4
9MWA	BUNGA SEPANG		9	06	36.1	44.5	29	35	1009.0					
CGVV			9	12	38.5	42.7	12	40	1013.2	05	2	18	7	3
CGBV	DAWSON	Canadian	9	18	38.7	42.6	25	40	1016.1	06	5	20	8	6
FRANCES			SEP											
ELJG	MIDAS ARROW		10	18	10.1	28.2	22	40	1018.0	02	1	99		2
TCCH	DALAMAN		16	00	26.8	47.7	17	35	1019.2	03	8			
WPHI	WASHINGTON	American	16	06	29.6	48.9	12	40	1009.5					
TCCH	DALAMAN		16	06	26.2	47.5	18	40	1019.5	03	11	18	7	8
SQFH	MIROSLAWIEC		16	06	31.8	47.5	22	45	1016.7					
SQFH	MIROSLAWIEC		16	12	30.7	47.1	14	90	1015.7					
SQFH	MIROSLAWIEC		16	18	30.0	46.8	19	80	1014.5					
OWCJ	NORDPOL		16	18	32.1	48.8	08	65	1003.4		4	18		5
OWCJ	NORDPOL		17	00	32.5	48.1	04	70			14			
SQFH	MIROSLAWIEC		17	00	29.7	47.9	23	50	1018.3					
OWCJ	NORDPOL		17	06	32.6	47.3	28	70	993.9		9			
SQFH	MIROSLAWIEC		17	06	29.4	48.8	23	40	1018.0					
OWCJ	NORDPOL		17	12	33.0	46.3	22	65	1011.3		3			5
JNCB	SHOZEN MARU	Japan	17	12	34.7	45.5	10	50	1009.0			10	8	15
OWCJ	NORDPOL		17	18	34.1	46.2	21	65	1010.2					
OWCJ	NORDPOL		18	00	35.2	43.7	18	50	1018.4		4	27		3
SHIP			18	00	35.5	46.9	35	55	995.3	07	7	99		
WSVB			18	12	40.1	45.1	07	50	1013.8	99	6	19	4	8
OWCJ	NORDPOL		18	12	35.8	39.3	18	35	1026.3		2	27		2
WSVB			18	18	40.3	48.6	01	50	1009.8	08	4	02	5	6
GOOZ	ARMADALE	British	20	12	48.0	32.0	19	35	1011.4	03	3	99	8	3
GEORGES			SEP											
6ZHF	ATLANTIC HOPE		5	18	28.9	67.5	18	35	1016.0					
6ZHF	ATLANTIC HOPE		6	00	28.0	68.0	22	35	1016.0					
SFAI			7	00	31.6	67.8	21	35	1007.5	06	3	23	5	3
D5ES	EASTERN RIVER		7	18	35.8	60.2	26	50	1002.5	06	3	22	1	4
A8WE	OBELIX		8	00	40.9	57.9	13	55G70	992.0					
5LPL	SALLY II		8	00	39.2	55.9	16	35	1000.4					
A8WE	OBELIX		8	12	41.2	54.6	28	35	1009.0					
KSLB			8	12	40.6	54.4	29	35	1008.1	05	3	27	6	4
3EKB			8	12	40.4	47.9	18	35	1015.0	06	3	16	6	5
SHIP			8	18	46.7	48.8	29	55	995.3	24	2	18	8	4
SHIP			8	18	46.6	48.7	23	50	994.5	06	3			
HERMINE			SEP											
6ZDC	ARGOLIS		19	22	16.2	74.7	07	40	1006.0		5			
D5KI			22	01	19.2	83.9	12	35	1007.0		3			
GPEY	BARRANCA	American	22	18	20.1	84.5	11	35	1002.2	05	4	12	5	10
ZFEK			23	15	20.3	93.5	07	35	1004.0					
ZFEK			23	18	20.0	94.0	07	50G60	1000.0			07		11
ZFEK			23	21	20.0	94.0	07	50G65	999.8					
			24	00	20.1	94.0	09	10	1001.0					
IVAN			OCT											
GYAS			5	12	32.4	28.9	36	40	1002.8	08	4	06	7	5
GQOW	MANISTEE	American	11	18	33.0	30.9	03	35	1015.2	03	3	04	8	4
YTXT			6	00	33.3	29.8	07	35	1018.7	99	6	00	0	0
GWKH	BOOKER VIKING	British	6	18	33.5	33.9	04	35	1016.7	04	3	04	8	7
FNEI	CARIMARE		7	12	29.4	29.3	15	35	1014.9	02	4	00		0
DIES	POLOR ECUDOR	German	7	18	30.5	33.3	07	35	1005.0					
FNCW	ROUSSEAU		9	12	34.5	38.0	15	40	1022.0	06	5			
FNCW	ROUSSEAU		9	18	33.0	38.3	17	40	1015.0	06	5	13	8	6
CKGZ			10	00	35.9	39.6	12	35	1002.1					
SQFH	MIROSLAWIEC		11	00	38.7	38.8	22	35	1014.5					
KFCS	AMERICAN ARCHER	American	11	18	49.9	29.2	07	20			3	12	9	5
JEANNE			NOV											
WCOQ	CRISTOBAL	American	9	12	22.2	86.1	08	35	1009.0	05	3			
WCOQ	CRISTOBAL	American	9	18	21.2	85.2	15	35	1002.0	05	4	15	5	3
KPLF	CHRISTOPHER LYKES	American	9	18	22.4	85.3	08	35	1011.2	04	1	07	6	2
DGJL			9	21	21.8	86.1	04	35	1004.0	08	3	05	9	3
SHIP			9	21	23.3	85.5	07	35	1008.5	03	2	07	5	2
NMUD			10	00	23.3	85.6	06	40	1007.3	04	5	00	0	0

Call	Vessel Name	Nationality	Date	Time GMT	Ship Position Lat. °N	Ship Position Long. °W	Wind Dir. 10°	Wind Speed (kn)	Pressure (mb)	Sea Waves Period (sec)	Sea Waves Height (m)	Sea Swells Dir. 10°	Sea Swells Period (sec)	Sea Swells Height (m)
JEANNE (contd)			NOV											
SHIP			10	00	23.4	85.5	06	40	1008.5	03	2	09	5	2
SHIP			10	06	23.5	85.7	06	40	1007.1	03	2	08	4	2
GNBE	NORDIC LOUISIANA		10	18	25.7	86.2	07	35	1010.0					
SHIP			10	18	25.0	87.1	06	35	1010.0					
WIAF			11	00	26.6	85.7	10	50	1011.2	99	4	10	7	4
SHIP			11	00	25.1	87.6	06	40	1010.0					
KIEC			11	06	25.3	85.5	07	40	1007.5		2	09	7	5
SHIP			11	12	25.3	86.2	07	40	1004.1	06	5	08	8	5
	BARGE DOLPHIN		11	13	25.2	88.8	04	50			13-15			
CSCX	RIO CUANZA		11	15	25.8	85.3	03	45	1009.0		8			
KVXW	AMOCO DELAWARE	American	11	15	25.2	86.3	05	40	1006.4	07	9	06	6	8
H8TC			11	15	23.7	90.0	02	35	1009.2	09	4	1	0	11
	BARGE DOLPHIN		11	18	25.2	88.8	02	45			13-15			
5LPC	GETAFIX		11	18	25.2	89.2	03	40	1001.0					
5WWG			11	21	23.6	88.5	36	40	1003.0	04	5	36	4	5
KEHJ	WESTERN SUN	American	11	21	25.3	83.5	09	35	1008.4	07	5	99		3
KVVW	AMOCO DELAWARE	American	11	21	25.2	86.0	08	40	1005.4	09	4	08	1	5
NRDT	TANEY	American	12	00	24.2	87.4	35	95	1000.7					
KEHJ	WESTERN SUN	American	12	00	24.9	84.0	06	35	1010.5	05	5	09	5	3
DGEF			12	00	27.1	87.0	08	30	1012.5		3	09	1	
SHIP			12	09	24.4	89.6	03	80	1005.4		4	02	0	10
SHIP			12	12	24.5	89.5	03	80	1005.4	02	4	04	0	10
KEAJ	EXXON HUNTINGTON	American	12	12	26.2	86.0	07	40	1014.0					
DGEF			12	12	25.7	85.1	09	40	1010.0	03	3	05	5	10
KCBE	DELAWARE GETTY	American	12	12	26.8	90.7	05	35	1011.9	05	2	08	8	4
KADG	TEXACO MARYLAND	American	12	12	27.2	90.0	04	45	1012.5	02	2	04	3	5
NRDT	TANEY	American	12	18	24.7	89.7	06	55	1004.1	02	3	03	6	9
GPEY	BARRANCA	American	12	18	24.2	85.1	09	40	1011.0	04	5	09	7	8
GPHU	BAYANO	American	12	18	27.6	84.8	07	35	1015.5	03	2	08	8	3
KAVG			12	18	27.0	89.8	04	40	1012.5	02	2	04	2	3
5LWG	SOUTHWEST CAPE		12	18	25.7	92.5	04	35	1014.0	05	3	04	5	3
SHIP			12	21	26.9	84.3	06	35	1013.1	03	3	03	6	2
NRDT	TANEY	American	12	21	24.4	89.7	10	60	1002.4	02	3	04	6	9
KCDE	DELAWARE GETTY	American	12	21	26.7	89.7	06	40	1010.5	06	2	09	7	3
NRDT	TANEY	American	13	00	24.2	89.6	14	60	999.7	02	3	10	6	9
GPEY	BARRANCA	American	13	00	25.2	85.2	08	45	1013.0	05	6	08	7	9
KADG	TEXACO MARYLAND	American	13	00	26.6	88.3	07	45	1013.2					
KCDE	DELAWARE GETTY	American	13	00	26.8	89.2	07	40						
NRDT	TANEY	American	13	03	24.6	90.0	13	60	1003.0	03	3	08	8	8
VRCV			13	03	28.2	89.0	05	35	1013.4					5
NRDT	TANEY	American	13	06	24.2	90.0	13	55	1007.1	03	5	17	8	5
KADG			13	06	26.6	87.0	06	45	1011.9	02	2	04	2	5
GXEB			13	06	28.7	88.0	08	35	1017.2	05	5	07	8	4
SHIP			13	09	24.3	90.0	17	40	1009.1	03	3	07	8	3
VRCD			13	09	27.2	88.5	10	35	1010.0					
KCBE	DELAWARE GETTY	American	13	12	26.1	88.6	11	35	1009.8	06	2	09	4	3
EIDC	IRISH MAPLE	Irish	13	12	25.4	87.8	12	45	1013.7	04	2	10	6	6
GPAU			13	12	26.0	85.7	16	35	1015.5	03	2	11	7	4
KAOG			13	12	26.1	87.0	08	40	1014.9	02	3	09	2	5
GPEY	BARRANCA	American	13	12	27.6	86.9	11	40	1007.5	15	4	09	5	8
KADG	TEXACO MARYLAND	American	13	18	25.9	86.0	12	35	1013.2	02	1	12	1	4

KARL - NO DATA

Table 5. -- Meteorological data from stations in Texas during hurricane Allen, August 9-10, 1980

Location	Date	Pressure (mb) Minimum	Time	Maximum wind (kn) Sustained	Time	Gust	Time	Tide Height (ft) Above normal	Time	Rainfall (in)
Adams Gardens										8.36
Alice										15.65
Aransas Pass	10	994.2	0400	E54	1200	92	0645	7.5		17.49
Beeville										12.31
Brownsville	9			N42	2252	N58	2233			
Brownsville	10	988.5	0645							6.92
Corpus Christi	10	991.5	1056	ESE47	1055	ESE80	1020	8.9[1]		10.26
Corpus Christi Naval Air Station	10							9.0[2]		8.79
Edinburg										14.51
Falfurrias										12.49
Galveston	10	1000.7	0700	22	0700	37		8.0[2]		
Georgewest										13.09
Houston	9			E24	1755	ESE35	1954			
Houston	10	1008.5	0650							
Kingsville										11.22
McAllen										12.09
McCook										6.29
Mercedes										5.98
Mission										6.81
Port Arthur	9			E23	1853	E33	1910			
Port Arthur	10	1000.4	0957							
Port Mansfield	10					104				
Port O'Connor	10	1005.4	1200			68		4.9		
Raymondville		969.9	1200							7.14
Rio Grand City										1.78
San Antonio	10	977.0	2053			39				1.89
Santa Rosa										4.49
South Padre Island	10							7.9	0600	
Victoria	10	1000.0	0985	22		46	1302			

(All times GMT)

[1] Height above mean low water

[2] Estimated

HURRICANE BONNIE - AUGUST 14-19

An elongated cloud mass near the Cape Verde Islands developed two centers of action on August 13. Satellite pictures suggested that the more westward of the two systems became a tropical depression by 0000 on August 14. At 1545, the RUDDBANK passed through the system and reported winds of Force 8 (fresh gale) and a pressure fall of 7.2 mb in 1.5 hr to 1003.2 mb. At 1700 the ship's pressure fell to 999.9 mb, and at 1714 the winds increased to Force 9 (strong gale). Upon receipt of these reports at the National Hurricane Center, the depression was upgraded to tropical storm Bonnie.

Bonnie strengthened to a minimal hurricane by August 16 (fig. 16), while its companion system formed a tropical depression centered only 400 mi to the northeast of Bonnie's center. However, the depression dissipated and Bonnie tracked steadily northward for more

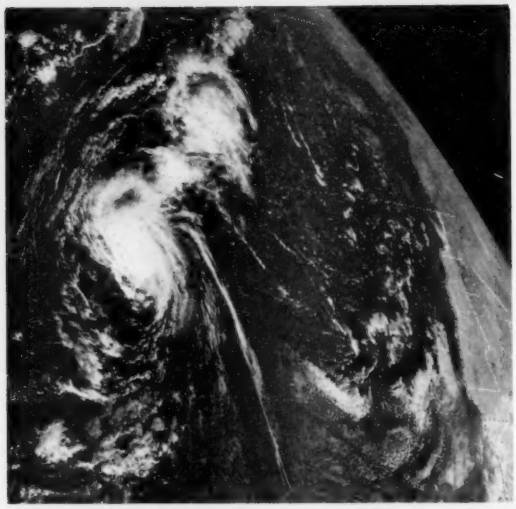


Figure 16.--Hurricane Bonnie and accompanying tropical depression on August 16.

than 1,000 mi before losing tropical characteristics midway between Newfoundland and the Azores on August 19.

Following the reports from the RUDDBANK, no other ship observations were received from the vicinity of Bonnie, but, based on estimates from satellite images, Bonnie's winds never exceeded 85 kn.

HURRICANE CHARLEY - AUGUST 20-25

Charley initially developed as a subtropical depression in a cool environment to the north of a front off the mid-Atlantic coast on August 20. During the following 3 days, the system described a counterclockwise loop while gradually gaining strength. When the center was about midway between Bermuda and Nova Scotia on August 22, the ALGENIB passed just to the north and reported winds of 60 kn and a pressure of 999.5 mb at 1200. The TOZUI MARU encountered 50-kn winds and a pressure of 1005 mb 100 mi northwest of the center.

During this period the storm gradually acquired the structure of a tropical cyclone and winds reached the threshold of hurricane force. On August 23 a reconnaissance flight found winds of 70 kn and a surface pressure of 989 mb, which is the maximum strength attained by the hurricane (fig. 17). As Charley accelerated toward the east it gradually weakened and

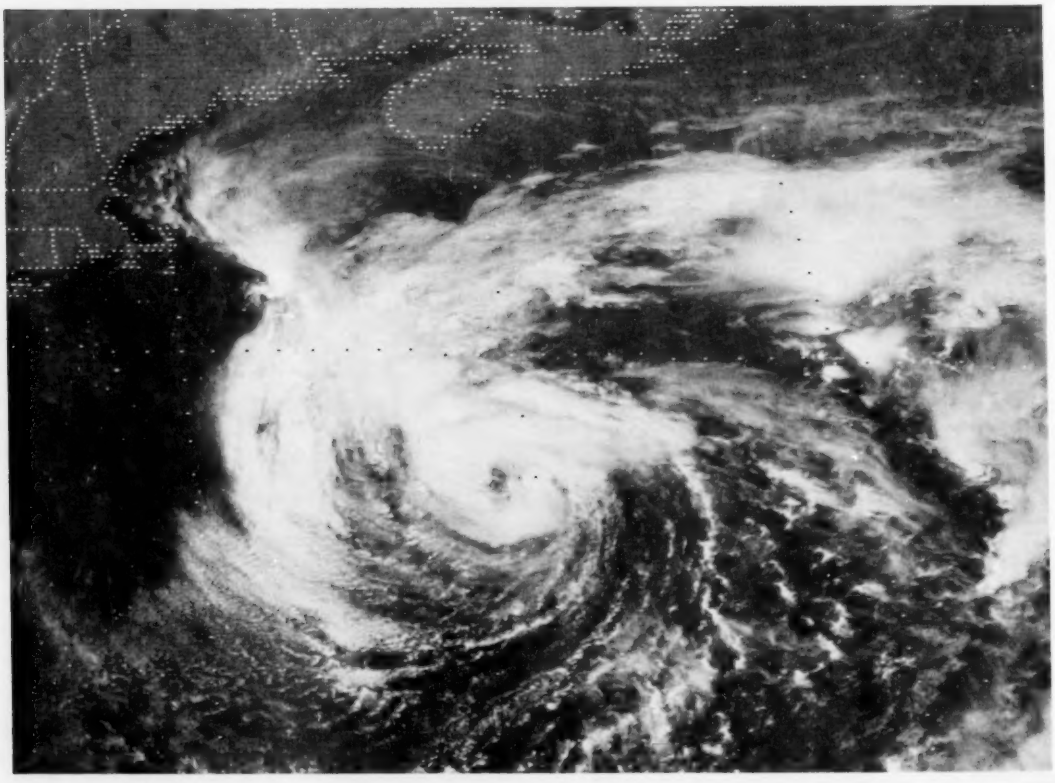


Figure 17.--Charley midway between Bermuda and Nova Scotia on August 23.

Figure 18.--Danielle approaching the upper Texas coast on September 5.

was eventually absorbed within the circulation of a large extratropical cyclone.

TROPICAL STORM DANIELLE
SEPTEMBER 4-7

A midtropospheric low and a weak tropical wave interacted to produce an area of disturbed weather over Florida and the eastern Gulf of Mexico in early September. The weather system tracked westward across the northern Gulf and formed a tropical depression on September 4 just off the Louisiana coast. The depression moved toward the west-northwest and became a tropical storm only 6 hr before the center crossed the Texas coast in the Galveston Bay area during the evening of September 5 (fig. 18).

Danielle's maximum strength occurred just before landfall. Offshore oil rigs reported winds of 50 kn and a sea-level pressure of 1004 mb. Tides along the Texas and Louisiana coasts were no more than 2 to 3 ft above normal and wind damage was negligible.

The main impact of the storm was caused by heavy rain, which spread westward across Texas. Rainfall at the Beaumont airport established a 24-hr record of 17.16 in, resulting in major flooding. Farther west, a 25-in rainfall was recorded at Junction, Tex. Interstate Highway 10 was closed, and some evacuation was required in central Texas. However, monetary losses from flooding were minor. One death in Beaumont was attributed to the storm.

HURRICANES EARL (SEPTEMBER 4-10), FRANCES (SEPTEMBER 6-20), AND GEORGES (SEPTEMBER 1-8)

The fifth, sixth, and seventh storms of the season were all recurving hurricanes that originated from African waves. Earl and Frances developed into depressions near the Cape Verde Islands and continued

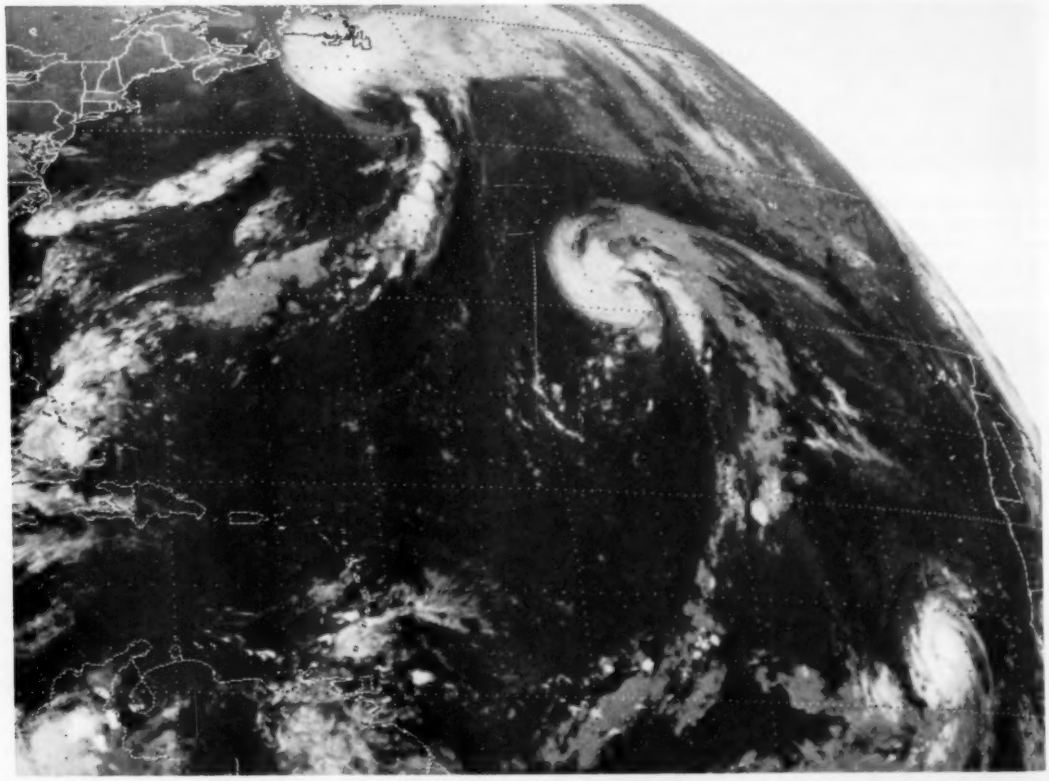


Figure 19.--GOES satellite infrared image showing Earl in the central Atlantic, Frances near the Cape Verde Islands, and Georges south of Newfoundland on September 8.

to strengthen into hurricanes. Earl became a hurricane on September 8 and was never more than a minimal one. Frances became a hurricane on the same day and eventually attained winds of 100 kn as it paralled Earl's track with a lag of several days. Both storms gradually turned north and then northeastward across the central North Atlantic, finally dying over the northern waters (fig. 19).

Meanwhile, a tropical wave which had preceded the two waves that developed into Earl and Frances continued westward instead of turning north. This wave organized into a tropical depression during the first few days of September, but then weakened to a disorganized cloud system which passed to the northwest of the Leeward Islands.

The residual weather disturbance eventually interacted with an upper level cold-core low, which culminated in the formation of a subtropical depression on September 5 about 300 mi northwest of Bermuda. It slowly took on the appearance of a tropical cyclone. It became a tropical storm on September 7 and a hurricane the next day. Georges is only the third storm since 1886 to become a hurricane north of the 40th parallel. The others are Candice in 1976 and an unnamed hurricane in 1971. Georges reached maximum strength of 70 kn on September 8 as it passed southeast of Cape Race, Newfoundland, but lost identity soon thereafter over cold North Atlantic waters.

TROPICAL STORM HERMINE
SEPTEMBER 20-25

Hermine became a tropical storm early on September 21 about 80 mi east of the eastern tip of Honduras. The storm brushed northeast Honduras and made landfall on the following day just north of Belize City, Belize (fig. 20). Except for local heavy rain, the storm had little impact as it crossed the Yucatan Peninsula and emerged into the Gulf of Campeche. Turning toward the southwest, the storm crossed the coast about 100 mi southeast of Vera Cruz, Mexico, where it drifted inland and dissipated.

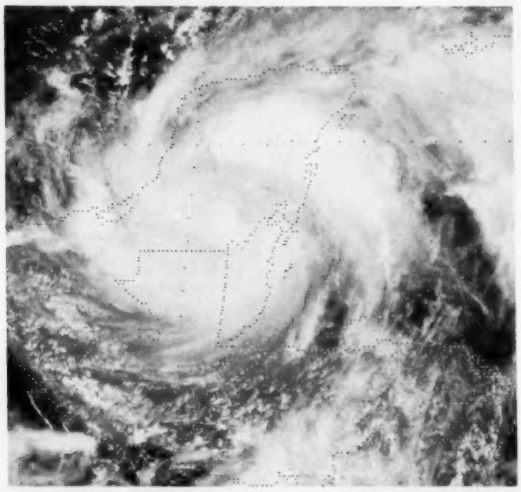


Figure 20.--Hermine crossing the Yucatan Peninsula on September 22.

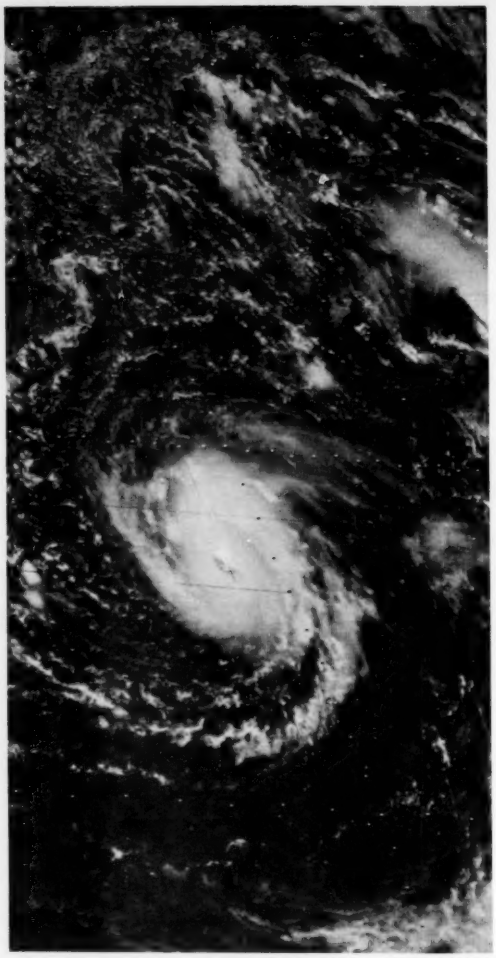


Figure 21.--Ivan looping south of the Azores on October 6.

HURRICANE IVAN - OCTOBER 1-11

The area of formation, process of development, and direction of movement of hurricane Ivan were all very unusual. It formed from a large, intense, extratropical low-pressure system which had migrated from near Portugal to the vicinity of the Azores in late September and early October. Near the center of this large cyclonic circulation a tropical storm formed on October 4 and strengthened to a hurricane the following day. No previous hurricanes are known to have developed where Ivan formed (fig. 21).

Ivan first headed toward the southwest, then did a counterclockwise loop, headed westward, and finally turned toward the north-northeast, passing west of the Azores on October 10. It headed over the cold northern waters and met a fate similar to that of Bonnie, Frances, Earl, and Georges.

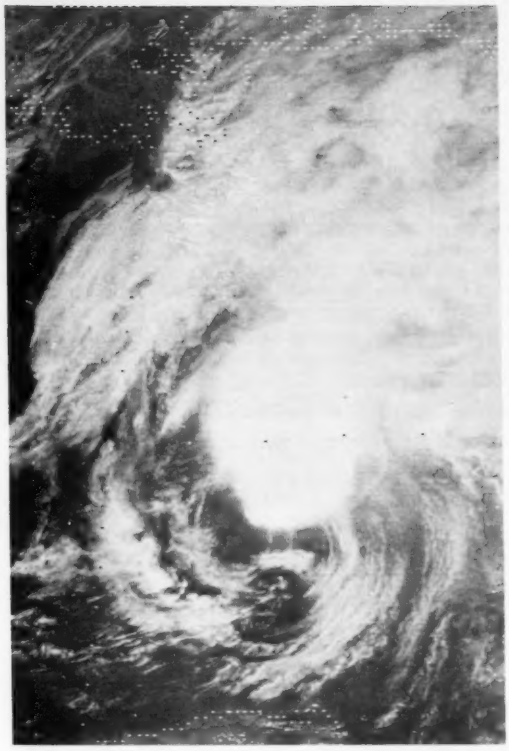


Figure 22.--Jeanne becomes a hurricane in the Gulf of Mexico on November 11, the only hurricane on record to form over the Gulf in November.

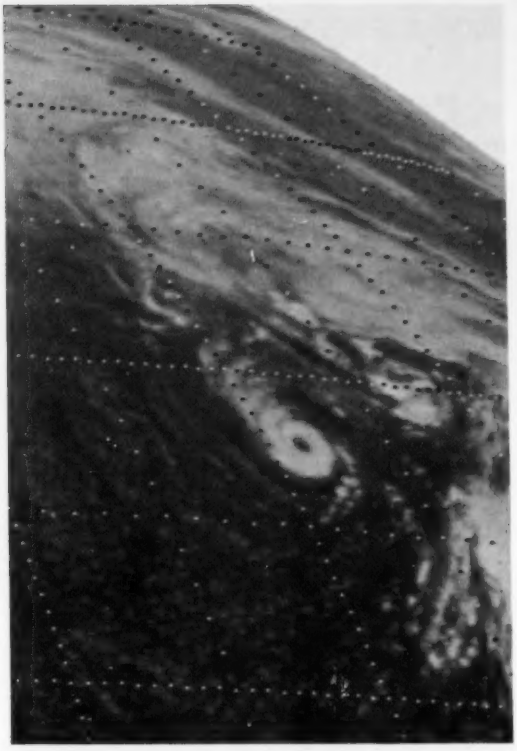


Figure 23.--Karl was a rare late-season hurricane over the eastern Atlantic on November 26.

HURRICANE JEANNE - NOVEMBER 7-16

Jeanne was one of three November hurricanes in the Gulf of Mexico during this century and the only one to strengthen into a hurricane while over Gulf waters. The unseasonable storm apparently caught several ships by surprise. Two barges broke loose from their towing vessels in the high seas and winds. One of the barges, an oil rig tender with 16 persons aboard, was carried along near the center of the storm for several hundred miles into the central Gulf of Mexico before being recovered with the aid of the Coast Guard vessel USCGC TANEY.

As Jeanne became a hurricane and turned toward the central Gulf on November 11, a record-breaking rainfall on the fringes of the hurricane's circulation deluged Key West, Fla. (fig. 22). During the 24-hr period, 11/0600 to 12/0600, 23.28 in of rain fell there, including a 6-hr total of 13.58 in.

Jeanne weakened to a tropical storm during the evening of November 12 after maintaining hurricane strength for only about 30 hr. The weakening storm briefly reversed its westward course and dissipated over the open waters as cool dry air was entrained into its core.

HURRICANE KARL - NOVEMBER 25-27

The occurrence of Jeanne in mid-November was unusual, but hurricanes are even rarer in late November. So, hurricane Karl will be remembered for prolonging the 1980 hurricane season into the late fall (fig. 23).

Even though a small percentage of all hurricanes form from extratropical cyclones, Karl was the third storm of the year to do so; the others were Charley and Ivan. Satellite pictures suggest that Karl became a hurricane at 1800 on November 25, when the storm was about 600 mi west-southwest of the Azores. Karl never became more than a minimal hurricane and weakened as it passed within about 200 mi northwest of the westernmost Azores on November 27.

Hints to the Observer

WIND DIRECTION

Reporting accurate wind direction and speed is probably one of the most difficult meteorological observations made by the mariner, particularly if he has to estimate rather than read a sensor. He has to determine the speed and direction of a moving air mass, which is not steady from a moving platform. The relative speeds and directions may differ radically, and the apparent wind must be adjusted to obtain the true wind.

Wind directions are to be reported to the nearest 10 degrees of the compass. A summary of wind directions reported from U. S. cooperating ships using 31,067 observations was prepared by Robert G. Quayle of the National Climatic Center, Asheville, N.C. The study indicated a definite bias toward the 16 points of the compass (fig. 24), and especially the 8 principal points. The bias may be influenced by the prominence of the principal points printed on the compass.

A similar study by Quayle on the direction of swell waves (Mariners Weather Log, Jan. 1980) indicated the same bias tendency toward the 8 and 16 principal points.

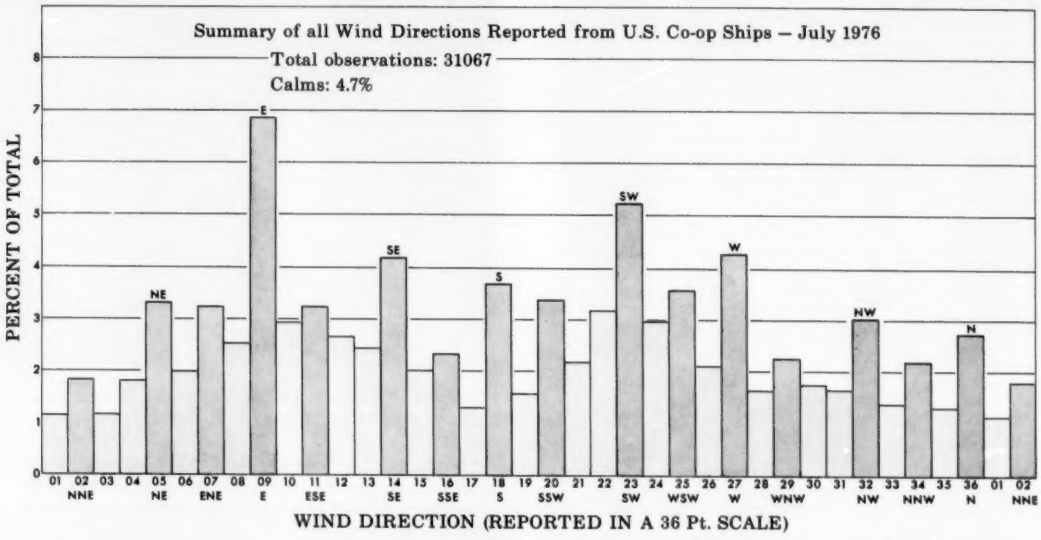

Summary of all Wind Directions Reported from U.S. Co-op Ships – July 1976
Total observations: 31067
Calms: 4.7%
PERCENT OF TOTAL
0
1
2
3
4
5
6
7
8
NE
E
SE
S
SW
W
NW
N
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 01 02
NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW N NNE
WIND DIRECTION (REPORTED IN A 36 Pt. SCALE)

Figure 24. --Frequency distribution of wind direction reports shows bias toward 16 points.

Tips to the Radio Officer

Larry Murphy
National Weather Service, NOAA
Silver Spring, Md.

NEW FORECAST PRODUCT FOR NEW YORK BIGHT AREA

The Weather Service Forecast Office at New York City is now issuing an offshore forecast for a portion of the New York Bight area, north of 40°N and west of 72°W. This forecast may be heard on Coast Guard broadcasts from Shinnecock, NY - NMY-41, 2670kHz, at 0020 and 1220 GMT; and Cape May, NJ - NMK, 2670kHz at 1103 and 2303 GMT.

RADIOTELEX SERVICE AT VANCOUVER, B.C.

The Canadian Coast Guard Radio Station at Vancouver/VA1 is now providing radiotelex service as follows:

Selcal Number 1.00581

Transmit (kHz)	Receive (kHz)
4354.0	4174.5
6498.5	6260.5
8717.0	8356.0
13091.5	12511.5
17213.0	16676.0
22576.5	22207.5

Broadcast Schedule

Time (GMT)	Frequency (kHz)
1000	13091.5
1800/2200	4354.0

Broadcast content will be weather synopsis and forecasts for Queen Charlotte Straits, Johnstone Straits, Queen Charlotte Sound, West Coast Vancouver Island, Juan De Fuca, Strait of Georgia, Hecate Strait, Dixon Entrance, and West Coast Queen Charlotte Islands.

ALASKAN RADIOFAX

Radiofacsimile broadcasts of weather information will be available to mariners in Alaskan waters beginning March 11, 1981. The broadcasts will be made from Coast Guard Radio Station, Kodiak, and are a joint National Weather Service and Coast Guard undertaking.

The broadcasts will begin with three chart transmissions daily and increase gradually until the full schedule is implemented on May 25. Two experimental Fisheries Aids charts will be added on April 15. The proposed schedule is given in table 6.

CORRECTIONS TO WORLDWIDE MARINE WEATHER BROADCASTS, JUNE 1980 EDITION

Page 41

2-0270 Cape May, NJ NMK
Delete times 0020, 1220. Insert 1103, 2303.

Page 43

2-0420 Mobile, AL NOQ
Delete time 2200; insert 2220.

2-0446 Berwick, LA
Change call sign to read NMG-37.

Page 56

Insert new station:

2-1505	Channel Island, CA		NMQ-8
0503, 1303		2670	W, F
2103			
0203, 1803		157.1 MHz	W

Table 6.--National Weather Service/U.S. Coast Guard radiofacsimile transmission schedule, Kodiak, Alaska

Product	Transmission time (GMT)	Start date
Surface weather analysis 00 GMT	0400	March 11, 1981
Surface weather analysis 12 GMT	1600	March 11, 1981
Surface weather prognosis 24 hr	1010	March 11, 1981
Surface weather analysis 06 GMT	1000	April 1, 1981
Surface weather analysis 18 GMT	2200	April 1, 1981
5 day weather outlook	1020	April 1, 1981
5 day weather outlook	2210	April 1, 1981
Sea surface temperature/ice analysis	2250 (Wed., Fri.)	April 15, 1981
Sea surface temperature/ice analysis	0430 (Thurs., Sat.)	April 15, 1981
High seas wave forecast	To be announced	April 15, 1981
Fisheries aids chart #1 (NASA-JPL)	2300	April 15, 1981
Fisheries aids chart #2 (NASA-JPL)	2320	April 15, 1981
Marine forecast summary 12 hr	0410	April 30, 1981
Marine forecast summary 24 hr	0420	April 30, 1981
Marine forecast summary 12 hr	1610	April 30, 1981
Marine forecast summary 24 hr	1620	April 30, 1981
Surface weather prognosis 24 hr	2220	May 25, 1981
Sea ice forecast	2230	May 25, 1981

Transmission frequencies 4298 and 8459 kHz

ACKNOWLEDGMENTS

Thanks to Richard Entricken, REO, CHRISTOPHER LYKES, for recent information relative to the marine weather program.

Marine Observations Program

J.W. Nickerson
National Weather Service, NOAA
Silver Spring, Md.

CORRECTION TO NEW SYNOPTIC WEATHER CODE

There were errors in the Full Form of the new synoptic weather code as published on page 16 and 17 of the January-February 1981 (vol. 25 no. 1) issue. One error was in the first group of the Full Form. The group should read $i_R i_x$hVV. The large H should be changed to a small h as indicated in the Abbreviated Form.

There were two errors in the second group of Section 2. In the second group the letter "O" should be the number "0" and the third T should also have a sub w. The group should read $0s_nT_WT_WT_W$.

Sorry about that.

SHIP WEATHER OBSERVATIONS

Weather observations are made primarily for your own safety. Weather forecasts and warnings are based upon weather observations. The more observations, the greater the detail of the weather map analysis. More observations don't always mean better forecasts. A lot depends upon the skill of the forecaster, but fewer observations always mean poorer forecasts.

Weather maps are analyzed for 0000, 0600, 1200, and 1800. Weather observations should be made as close to that time as possible. This is because the analysis is like a photograph of a changing situation. We freeze the action at the observation times. These are called synoptic observations because they are all made at the same time. To get your observation on the weather map it must be received before the data cut-off time. Data cut-off times vary depending on the area and type of analysis. For example: the data cut-off time for the North American Surface Chart, which includes most of Mexico and Canada and approximately 1,000 mi off each coast, is synoptic time plus 40 min, i.e. 0040, 0640, 1240, and 1840. For the Northern Hemisphere Surface Chart the cut-off time is synoptic time plus 1 hr and 50 min. The data must then be plotted and analyzed and then work on a forecast can begin.

There are later maps for other purposes and the data are used even when it is received at a later time. However, the best forecasts will result from the observation being received before 1 + 50 cut-off time of the Northern Hemispheric Chart. Of course, it takes time to transmit the observation, copy it at the coastal radio station, relay it to the distribution centers, and finally to the meteorological centers. Record the observation and radio it off the ship as quickly as possible so that it may be used in making the forecast.

Observations should be made from the time the ship is underway, including the harbors, bays, and coastal waters. The weather a few miles off the coast can be greatly different than at a land observing site a few miles inland. Moreover, in the near-shore area you can transmit your observations over voice frequencies. An evaluation of the January 1981 observations indicates an increase in near shore data. This is highly appreciated.

At the synoptic weather map times of 0000, 0600, 1200, and 1800, the weather observations should be transmitted to a coastal radio station. But, how often should the weather observation be recorded on the Ship's Weather Observation Form 72-1? When I was aboard ship a weather observation was made on each hour, 24 hours a day. There are several good reasons for this:

- When you observe the weather you define the various elements. That is a lot different from just "looking" at the weather.
- When you record it, naturally you look at the previous recorded observation and note the changes. A moving ship can move into a weather system quite rapidly.
- By recording the weather hourly on the Form 72-1, the changes are quickly recognized and early action can be taken to prepare for heavy weather, or make course alterations to lessen the effects of a storm.
- Should an accident occur your weather records and those of other ships in your area could be extremely valuable in claims or admiralty court.

NEW PROGRAMS THAT AFFECT THE MARINER

GOWON

The Gulf Offshore Weather Observing Network (GOWON) has been in operation for a little over a year (started October 1979). This network consists of volunteer observers on petroleum platforms and drilling rigs in the Gulf of Mexico. At the last count there were 58 platforms and drilling rigs participating.

Except for three data buoys which are located along latitude 26°N, these GOWON observation stations are generally located within 150 mi of the Louisiana and Texas coast. Most of the stations are located within 50 mi of the coast.

The additional observations have resulted in improved forecasts and are particularly important for providing early warnings of storm developments in the western and north central Gulf. This should in no way lessen the need for shipboard observations.

MAILING THE SHIP'S WEATHER OBSERVATIONS, NOAA FORM 72-1

A few months ago we started a new system of handling the Form 72-1. Instead of sending the Form 72-1 to the National Climatic Center directly, you should now mail them to your servicing Port Meteorological Officer (PMO). He will scan it for obvious errors, fill your supply requests and answer any questions you may have. This procedure should speed up our services to you.

Your servicing PMO will provide you with pre-addressed envelopes for your convenience. Please mail your Form 72-1 collection in these envelopes after each transocean voyage that ends in a U.S. port. If you are

stopping at various U.S. ports after mailing out the Form 72-1's at your first U.S. port of call you may delay mailing the others until the last U.S. port before your next transocean voyage.

You should use a new page for each leg of your voyage, i.e., one page for Los Angeles to San Francisco and another page for San Francisco to Seattle. At least leave several blank lines between each port and mark the end and start of each leg, i.e. Entered Los Angeles, CA 0520Z Jan. 17, 1981. Underway from Los Angeles for San Francisco, CA 1630Z Jan. 19, 1981. If the month ends during a voyage, the new month should be started on a new page.

The Form 72-1, that will be issued starting with the new code format in January 1982, will have spaces for the names of the captain, radio officer and observers. This will help us locate people when there are crew changes. You will help us if you will print this information - name and rate - on the back of one of the present Form 72-1's in each collection of forms that you mail to the servicing PMO. You are also invited to use this space to write questions or comments to the PMO, or if you prefer, include these on a separate sheet of paper.

Your servicing PMO will collect all of the Form 72-1's from the various ships that he services and forward them to the National Climatic Center as a group. We hope this will speed up supplies to your ship and result in better training of the observers.

COASTAL, HARBOR AND BAY DATAC

There are several initiatives to improve the data acquisition (DATAC) in the near-shore (coastal) areas, and actually in the harbors and bays. We have been talking to private and commercial fishing groups, the National Marine Fisheries Service, the Maritime Administration, NOAA groups and the U.S. Coast Guard about improved observations near the coast and actually within the harbor and bays.

The value of improved coastal, harbor and bay weather forecasts to the recreational boater and the coastal fisherman is obvious. But, how about the merchantman? He could start preparing for port long before docking. He could modify his speed, or course for fog patches, winds, or seas that might affect his time of arrival dockside.

Hurricane Alley

Dick DeAngelis
Environmental Data and Information Service, NOAA
Washington, D.C.

We have finished the 1979 season of our global tropical cyclone experiment. To my knowledge this is the first time monthly global tropical cyclone tracks have been published in a single source. The success of this attempt was made possible only by the generous help offered by the meteorological services of the tropical regions involved. In the South Indian Ocean we relied upon Reunion and Mauritius, while South Pacific data were made available by Australia, New Zealand, New Hebrides, and New Caledonia. In the North Indian Ocean India and the Joint Typhoon Warning Center (JTWC) were contributors. The western North Pacific was covered by the JTWC with help from Hong Kong, while the eastern Pacific was summarized by the U.S. Central and Eastern Pacific Hurricane Centers. The North Atlantic region data were furnished by the National Hurricane Center. And, of course, the entire tropical region was under the watchful eye of the National Earth Satellite Service (NESS).

We hope to continue this program into the 1980's. Our next issue will contain the global tracks for January and February 1980. Once again, thanks to all our partners--1979 was a very good year.

SOUTHERN HEMISPHERE
NOVEMBER AND DECEMBER 1980

Five tropical cyclones, including three hurricanes, came alive south of the Equator during the last 2 mo of the year. Both the December storms reached hurricane strength off northwestern Australia. The three November cyclones roamed the waters west of 100°E. Overall the activity was slightly less than normal (fig. 25).

Hurricane Alice played havoc with fishing vessels in the South Indian Ocean in November. On the 8th a message received from the SIN LONG No. 21 near 10.5°S, 86.5°E, indicated the fishing vessel was listing badly in a very heavy storm and needed immediate assistance. From Canberra an intensive air and sea search mission was launched as the ship was only about 50 mi from Alice's center, where winds were estimated at 95 kn with gusts to 115 kn. An oil slick was sighted early on the 9th, but there was no sign of the vessel or liferafts. Later, the MELBOURNE EXPRESS rescued seven of the Taiwan fishermen some 600 mi west of the Cocos Islands; twelve of their shipmates were not found. The liferaft of the rescued crewmen was first spotted by the container vessel NEW ZEALAND STAR at 0700 on the 9th. Meanwhile, the Coastal Surveillance Centre at Canberra received a message that the bulkcarrier FORT FRASIER received a distress call at 0330 on the 9th from a Korean fishing vessel the GAMMIRI No. 5 that she had "run on a rock" near the center of Alice, whose winds were estimated at 120 kn and more. Air rescue units heard weak signals on the 10th, but sighted nothing. On the 11th all crewmen of the GAMMIRI No. 5 were rescued by another fishing vessel of the same company. The vessel is believed to have sunk.

Alice was one of the strongest storms to develop in this part of the world. She peaked on the 9th, when satellite estimates of her maximum windspeed ran as high as 135 kn.

Several weeks later Bert formed in this same area,

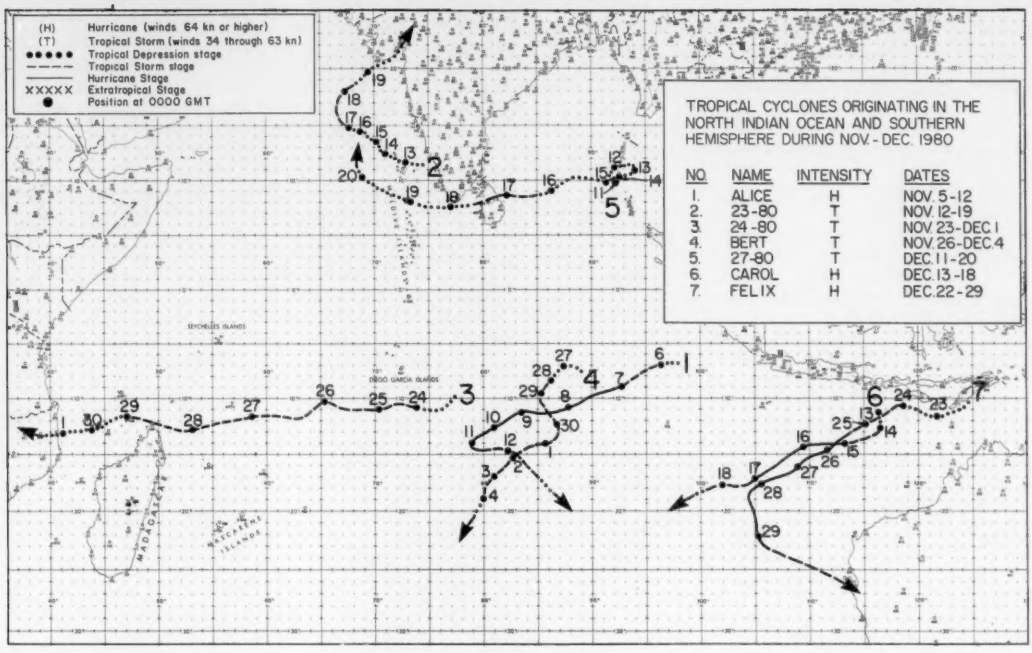

(H) Hurricane (winds 64 kn or higher)
(T) Tropical Storm (winds 34 through 63 kn)
Tropical Depression stage
Tropical Storm stage
Hurricane Stage
XXXXX Extratropical Stage
Position at 0000 GMT
TROPICAL CYCLONES ORIGINATING IN THE NORTH INDIAN OCEAN AND SOUTHERN HEMISPHERE DURING NOV.-DEC. 1980
NO. NAME INTENSITY DATES
1. ALICE H NOV. 5-12
2. 23-80 T NOV. 12-19
3. 24-80 T NOV. 23-DEC. 1
4. BERT T NOV. 26-DEC. 4
5. 27-80 T DEC. 11-20
6. CAROL H DEC. 13-18
7. FELIX H DEC. 22-29
SEYCHELLES ISLANDS
DIEGO GARCIA ISLANDS
MADAGASCAR
MASCARENE ISLANDS

Figure 25.--North Indian and Southern Hemisphere tropical cyclone tracks, November and December 1980.

but he never strengthened beyond tropical-storm intensity. His maximum winds were estimated at about 50 kn on the 29th.

Shortly before Bert came to life, tropical storm No. 24-80 developed a few hundred miles southeast of the Diego Garcia Islands. This system moved westward, crossing the northern tip of Madagascar on the 28th and the African coastline on December 1. Maximum winds climbed to near 60 kn on the 25th.

Carol and Felix popped up south of Indonesia in December. Carol developed southwest of Sumba on the 13th, while Felix came to life on the 22d off Timor. Both moved on a west-southwestward track out to 105°E, where Carol continued but Felix recurved to the southeast. Carol's winds peaked on the 16th, when they were estimated at 80 to 90 kn. By the 18th, however, Carol weakened to tropical-depression strength. Felix reached hurricane intensity on the 25th. Winds climbed to 80 kn late in the day. Peak winds occurred on the 28th when they were estimated at 100 kn. However, by the time he reached the coast, Felix dropped to tropical-storm strength.

NORTH INDIAN OCEAN
NOVEMBER AND DECEMBER 1980

Two tropical storms developed during this period; one in each basin, one in each month, and nearly one month apart. No. 23-80 was spotted along the Malabar coast on the 12th of November. Moving on a parabolic track, the Arabian Sea system reached tropical-storm strength on the 17th. Maximum winds climbed no higher than 40 kn before the storm dissipated as it moved into the Gulf of Cambay.

The Bay of Bengal system meandered through the Andaman Islands during its formative stages in mid-December. It wasn't until the 16th, while on a beeline for Sri Lanka, that the system reached tropical-storm intensity. No. 24-80 crossed the island as a minimal tropical storm on the 17th. Later in the day it fell to depression intensity. The tropical depression crossed through the northern Maldive Islands on the 19th and dissipated the following day.

TROPICAL CYCLONE WATCH - 1981

The tropical cyclones that have developed through March 1981 appear in table 7. This list is preliminary.

Table 7.--World tropical cyclone watch, 1981

South Indian Ocean			
Florine	01-81	H	Jan.
	04-81	T	Jan.
Helyette	06-81	T	Jan.
	10-81	T	Feb.
Johanne	16-81	H	March

Western North Pacific			
Freda		H	March

Australia-South Pacific			
Arthur	02-81	T	Jan.
Mabel	03-81	H	Jan.
	05-81	H	Jan.
Betsy	07-81	T	Jan.
Cliff	08-81	H	Jan.
Eddie	09-81	T	Feb.
Daman	11-81	T	Feb.
	12-81	T	Feb.
Neil	13-81	H	Feb.
Freda	14-81	H	Feb.
	15-81	T	March
Max	17-81	H	March

On the Editor's Desk

BOWDOIN MAY REVISIT THE ARCTIC

This exciting article is reprinted with the kind permission of NEMAS INFORMATION of the New England Marine Advisory Service. The photographs were supplied by Schooner Bowdoin Inter Islands Expeditions, Inc.

On July 17, 1921, a front page story in the New York Times datelined Wiscasset, Maine, reported that "Donald B. MacMillan and six adventurous followers sailed down the Sheepscot River today bound for Baffin Land. They were cheered by 2,000 friends and admirers."

The expedition planned to map for the first time the vast arctic island southwest of Greenland as well as to carry out field work in zoology, botany, meteorology, and terrestrial magnetism.

The wooden vessel carrying them was a small two masted schooner named BOWDOIN which MacMillan, a veteran of the Peary expedition to the North Pole in 1909 had designed to his own specifications and named for his alma mater, Bowdoin College. In the next 33 years, BOWDOIN made 25 more trips to the far north under MacMillan's command, logging 300,000 miles through snow and ice and heavy seas without a single fatality. Although she was believed to be the smallest vessel ever to go into those punishing waters she was, as her commander claimed, "undoubtedly one of the strongest." During her working career, she withstood the crushing power of ice floes, being thrown flat on her side on the ice for long periods and being frozen in for months on end (fig. 26). But in 1957 when MacMillan, then 83 years old and a rear admiral, turned her over to Mystic Seaport she was as game as ever.

And in 1981, 60 years after her launching, the indomitable BOWDOIN may make still another voyage to the arctic region if the group of admirers who have organized to restore her succeed in their efforts on time.

BOWDOIN now belongs to a non-profit educational group in Maine: Schooner Bowdoin Inter Islands Expeditions, Inc., headed by Dr. Edward K. Morse of Camden, Maine, a surgeon who had sailed to the Arctic with MacMillan. Although she was still sufficiently seaworthy to make short cruises in Penobscot Bay during the summers of '78 and '79, the group aims ultimately to have her completely restored to mint condition - an undertaking which it is estimated will cost a total of $385,000, more than ten times the $30,000 it cost to build her originally. Thanks to the group's efforts, BOWDOIN was recently registered in the National Register of Historic Places and received $95,000 challenge grant from the National Trust for Historic Preservation under its Maritime Heritage Preservation Grants Program. A nationwide campaign is now underway to raise the remaining $290,000.

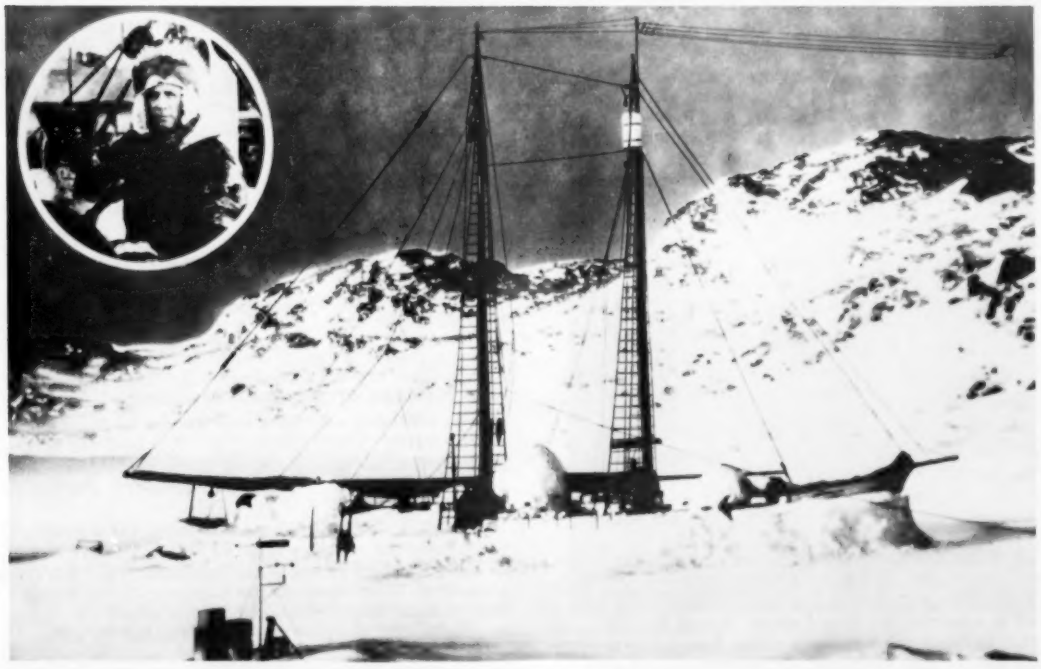


Figure 26.--The BOWDOIN "frozen in" for a winter at Refuge Harbor, Greenland--1925.

Figure 27.--The BOWDOIN under full sail.

What makes the price tag so high? A clue may lie in this description of the vessel designed by William Hand and built in '21 by Hodgdon Brothers of East Boothbay from specifications MacMillan had drawn up during the four years (1913-1917) he was marooned in Greenland, waiting for a rescue ship strong enough to penetrate the ice.... "A 60-ton schooner, 88 feet long with a beam of 21 feet and a draft of 9 1/2 feet. Double-planked and double-framed with white oak and sheathed against ice with a five-foot belt of 1 1/2-inch ironwood, the toughest wood known. Her knockabout bow was spoon-shaped so that if she was unable to push through broken ice she could rise over it and crush it under her forefoot. A steel nose weighing 1800 pounds was fastened to her stem to aid in splitting ice, and the propeller to her engine was protected from floating ice by a skeg extending from the keel to the foot of her rudder. The original engine could burn a mixture of kerosene, whale oil and seal oil if necessary." The BOWDOIN was rigged like a conventional Grand Banks fishing schooner, but without a bowsprit or topmasts (fig. 27). For safety's sake, all of her sailing apparatus was within the gunwale. To give her stability, 21 tons of cement and iron ballast were molded into her bilges.

From earlier trips with Peary, MacMillan was well acquainted with the fates of big ships trapped by arctic ice, and he determined to build one smaller and sturdier. Later, he wrote of BOWDOIN, "it is possibly her small size which has saved her from destruction time and time again. Ships twice and three times her weight have, under the pressure of an enormous ice field, been crushed and ground to pieces. BOWDOIN, having what is known to the sailor as sharp bilges, manages to escape by rising up and out and away from danger."

Besides her unique construction, BOWDOIN has numerous other claims to fame. In 1954, MacMillan wrote: "two ships only have been built in America for arctic work: the SS ROOSEVELT by the loyal members of the Peary Arctic Club and the tiny schooner, BOWDOIN.... The ROOSEVELT took Peary to the northern shores of Grant Land from which he first reached the North Pole in 1909. Where is she now? Alone and forgotten, rotting away in the black mud of the Panama Canal."

The BOWDOIN, which always operated as an educational vessel with a crew of scientists, students and teachers, racked up many "firsts" in her career. She made the first circumnavigation of Foxe Basin, northeast of Hudson Bay and the first survey of Refuge Harbor in northern Greenland. The first message ever sent by shortwave radio from the arctic was sent by the BOWDOIN in 1925. (Call letters: WNP - wireless North Pole) She was also the first to use airplanes beyond the Arctic Circle. They were under the command of the then Lt. Commander Richard E. Byrd.

MacMillan made his last expedition in 1954 accompanied by his wife, Miriam, who had crewed on eight previous voyages and who still lives in Maine. Not wanting the fate of the ROOSEVELT for BOWDOIN, MacMillan turned her over to Mystic Seaport in Connecticut. But after keeping her for 10 years, the Seaport found it could not afford to maintain her.

A group from Maine bought her for $1 and towed her home. There, windjammer Captain Jim Sharp partially restored her and for several summers, she was again, as she had been under MacMillan's command, an instrument of education. Groups of young people were taken on two week cruises among the islands of Penobscot Bay while they learned about marine biology, seamanship, navigation and maritime history. Educational groups from around the country also chartered her for one and two-week cruises.

However, a marine survey last year showed that more rot than had been suspected existed in BOWDOIN'S hull and this summer she is at the Goudy & Stevens boatyard in East Boothbay where she will be completely restored. This costly and complex process involves completely removing her ceiling, or inside sheathing, to get at the massive frames and horn timber in her stem.

When the restoration is completed, BOWDOIN will once again become a seagoing school, offering instruction in all aspects of sail training, marine biology, botany, ornithology and geology of the Maine Coast and perhaps just once, for old times sake, of the Arctic, as well.

ADVENTURES OF THE CRYSTAL STAR

The following narrative was written by Don Olson, Seattle PMO. The CRYSTAL STAR logged 181 meteorological observations during the period September 19 and November 3. Of these 98 were transmitted by radio.

Probably one of the longest voyages for a powered vessel was the recent voyage of the M/V CRYSTAL STAR. The voyage began on September 18, 1980 from Longview, Washington on the Columbia River with a load of some twelve thousand tons of wheat for Japan. Arrival in Hiroshima Japan on November 3, 1980.

The ship's officers were Master, Captain Nely P. Salcedo; Chief Officer, Conrado B. Rosal Jr.; Second Officer, Eliedoro Salgade, Jr.; Third

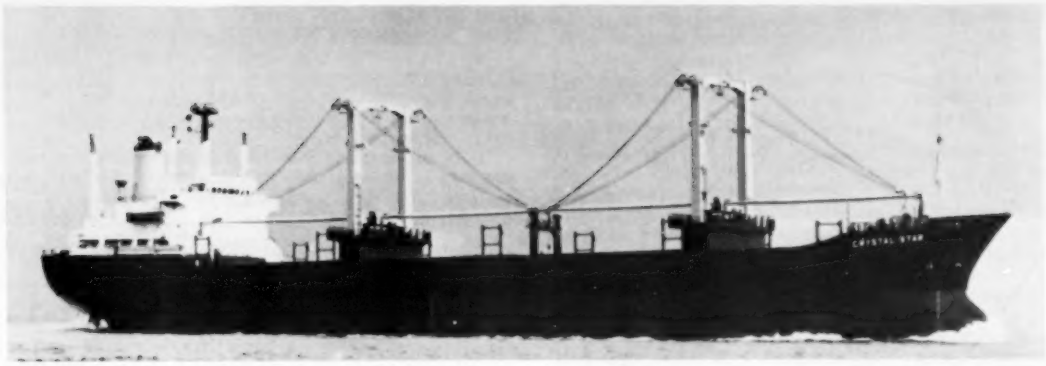


Figure 28.--The CRYSTAL STAR on her maiden voyage, October 1979. A year later she battled heavy weather for over a month on a trans-Pacific crossing.

Officer Archimredes Ladioray; Radio Officer, Marcele Bas Jr.

The voyage proceeded normally for the first ten days on a routine Great Circle track to Japan then on the evening of September 28th at position 49 degrees North, 161 degrees, 9 minutes East there was a loud bang that shook the vessel, the mate on watch on the bridge reported a complete loss of steering. After some frantic moments in the engine room and on the bridge they determined there was no visual structual damage to the ship. As the vessel only had power on their single screw they could not maintain a heading, only move in circles. Then it was a long wait for a tug to arrive from Japan to determine rudder damage. On October 8th the tug OCEAN DISCOVERER arrived, they sent divers down to check on the rudder and it was gone, only the rudder post remained. Then the tug attempted to tow the CRYSTAL STAR but was unsuccessful. A second tug was ordered from Japan and arrived on October 14th. This had been a long sixteen days drifting in the Pacific. This will be attested to by the ships weather observations that were taken and transmitted during this entire voyage. Then came the long slow tow by the two tugs to Hiroshima, Japan arriving on November 3rd.

There was only three short weeks before the M/V CRYSTAL STAR was headed back to the Pacific Northwest for a load of logs.

I would like to recommend a letter of commendation to the Captain and Deck Officers and Radio Officer for all of the excellent observations during the Longest Voyage.

The position they were adrift was very near the former Ocean Station SUGAR, 48°N 162°E which we manned in the early 1950's.

Most of the less than routine weather encountered by the CRYSTAL STAR was during the time she was rudderless. The most severe weather occurred on October 1 prior to the arrival of the tug OCEAN DISCOVERER.

The extratropical transformation of tropical storm Thelma was approaching the ship on September 30. An observation at 2300 indicated 45-kn easterly winds with 30-ft seas and swells. The 984-mb storm was about 250 mi to the southwest. At 0600 October 1 the storm was about 120 mi south of the CRYSTAL STAR who was being tossed about by 55-kn northeasterly winds, 16-ft seas, and 38-ft swells. The ship's barometer indicated 955 mb. About 0900 the center of the storm passed within 60 mi of the ship. Their 1100 and 1800 observations continued to indicate 55-km winds from the northwest and 33-ft confused waves. At 1100 the ship had drifted to 50.1°N, 161°E but by 1800 the northwest winds had drifted her south to 49.6°N, 161°E. By 0000 on the 2nd (figs. 28-30)

Figure 29.--The extratropical stages of Thelma battered the CRYSTAL STAR on October 1. The satellite photo was taken at 2021, October 1.

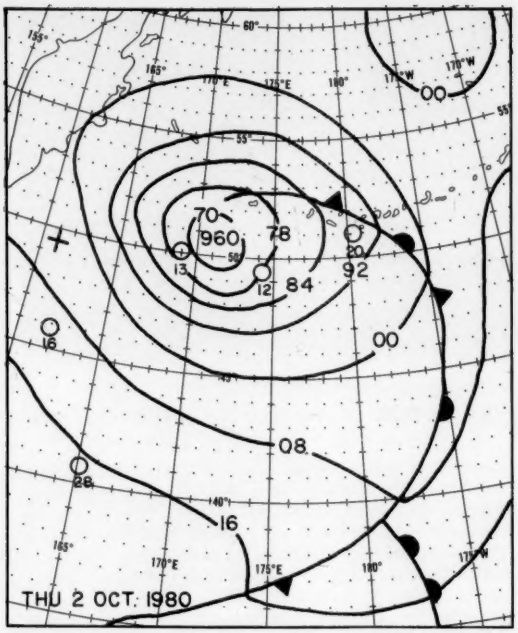


Figure 30.--The synoptic weather map at 0000 October 2 about 3-1/2 hr after the satellite photo in figure 29.

winds had decreased to 22 kn but the 33-ft swell continued. Finally by 0600 the waves were a respectable 10-ft. A more detailed description of this storm can be found in the September Smooth Log.

On October 10 a large deep LOW was over the Kamchatka peninsula and the tug had arrived. That day southwesterly winds blew up to 36-kn and the waves were 16- to 20-ft. The ship had drifted to the vicinity of 49.5°N, 164°E. By the 13th and 14th the LOW had split into two centers over the Bering Sea. The tighter gradient was near the CRYSTAL STAR midway between the LOWS and a HIGH to the southwest. Again the waves built to 16- to 20-ft with near gales. The second tug arrived. By the 18th they were being towed toward Japan and relatively weak LOWS moved both north and south of their location. In the combine westerly flow on the 19th the waves again built to 20-ft. On the 21st they were east of Ostrov Iturup (45°N, 151°E) and a frontal wave moved south of them. This brought 30-kn northeasterly winds and 21-ft waves from the east-northeast. The weather remained relatively mild the remainder of the voyage to Hiroshima.

NEW OCEANOGRAPHIC MONTHLY SUMMARY REPLACES GULFSTREAM

The gulfstream monthly magazine was discontinued after the December 1980 issue. The three-color format and the inclusion of a monthly scientific article made gulfstream production both costly and time-consuming, leading to many subscribers' comments about lack of timeliness of the data included. NOAA's National Marine Fisheries Service also terminated its monthly Fishing Information publication after the December 1980 issue because of budgetary limitations. Fishing Information was somewhat similar to gulfstream in that it consisted largely of contoured analyses of monthly mean sea surface temperature (SST) and anomalies.

Both publications have been replaced by a new one titled Oceanographic Monthly Summary. The new publication began with the January 1981 issue, and is jointly sponsored by NOAA's National Weather Service (NWS) and National Earth Satellite Service (NESS).

Oceanographic Monthly Summary includes computer-drawn oceanographic analyses for all United States coastal and offshore waters, and for large areas of the Atlantic and Pacific Oceans. There also are hand-drawn ocean features analyses with descriptive text for offshore areas having dynamic features of particular interest to users, such as the Gulf Stream, coastal upwelling, and Bering Sea ice. Users such as commercial fishermen and merchant shippers will receive similar hand-drawn analyses on a more timely basis (some weekly, twice-weekly, and thrice-weekly) to support their at-sea operational needs for marine data. The monthly publication summarizes monthly oceanographic conditions, presents seasonal and yearly trends, and shows anomalous conditions. The new publication is intended as general information and a planning guide for mariners and fisherman; as a design and long-term operations guide for offshore industries, and as a definitive source of basic oceanographic time-series analyses for research scientists and for other government agencies.

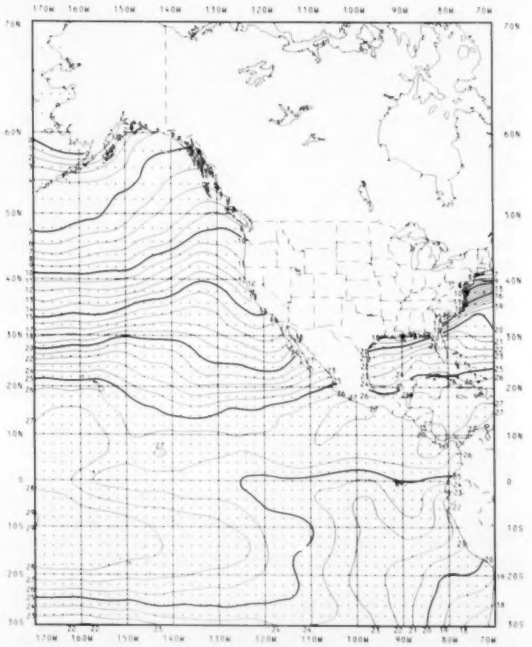


Figure 31.--Eastern North Pacific monthly mean sea surface temperature, January 1981.

Oceanographic Monthly Summary is printed only in black-and-white, consists largely of computer-drawn graphics, and will be distributed to its subscribers within 15 days after the end of each month. A standard table of contents is shown in table 8, and examples of the computer-drawn graphics are shown in figures 31 and 32.

Table 8.--List of contents for Oceanographic Monthly Summary.

Page	Contents
3	OceaNotes
4	Pacific SST - monthly mean
6	Pacific SST - anomaly
8	Pacific SST - yearly change
10	Atlantic SST - monthly mean
11	Atlantic SST - anomaly
12	Atlantic SST - yearly change
14	Bering Sea/North Slope ICE, with text
15	West Coast OCEAN FEATURES, with text
16	West Coast SST - monthly mean
17	West Coast SST - anomaly
18	East Coast OCEAN FEATURES, with text
20	East Coast SST - monthly mean
22	East Coast SST - anomaly
24	Subscription information

Global-scale analyses include contoured fields, analyzed on a 2° x 2° grid, for monthly mean sea surface temperature (SST), SST anomalies (comparing the monthly means with the same month for the previous monthly means to the climatological means for the area), and SST yearly change (comparing the monthly with the same month for the previous year). Areas for these analyses include:

West Pacific	30°S-70°N	100°E-170°W
East Pacific	30°S-70°N	170°W-70°W
Atlantic	30°S-70°N	80°W-20°E

Regional-scale analyses include both computer and hand-drawn analyses. Monthly mean SST and SST anomalies will be computer-analyzed on a 1° x 1° grid, showing both contours and data values. Yearly change analyses for the regional areas will begin in the January 1982 issue. Regional areas for computer analyses are:

West Coast	20°N-61°N	155°-110°W
East Coast	25°N-45°N	83°W-55°W
Gulf of Mexico	15°N-35°N	100°W-80°W

Five hand-drawn analyses are included. A Bering Sea/North Slope ice analysis shows ice age, thickness, and coverage, with a short descriptive text (fig. 33).

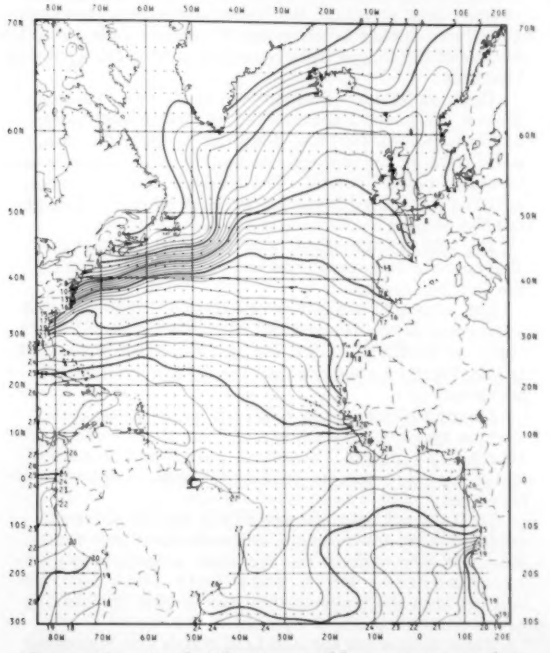


Figure 32.--North Atlantic monthly mean sea surface temperature, January 1981.

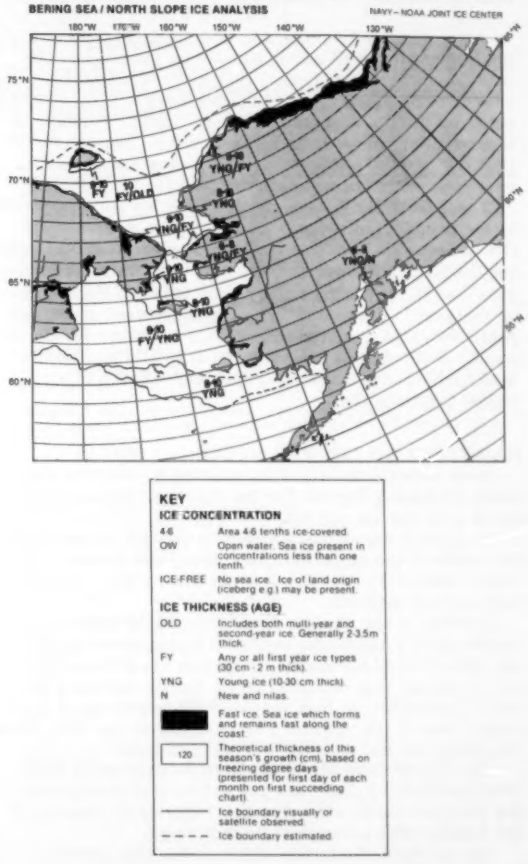

BERING SEA / NORTH SLOPE ICE ANALYSIS
NAVY - NOAA JOINT ICE CENTER
KEY
ICE CONCENTRATION
4-6 Area 4-6 tenths ice-covered
OW Open water. Sea ice present in concentrations less than one tenth.
ICE-FREE No sea ice. Ice of land origin (iceberg e.g.) may be present.
ICE THICKNESS (AGE)
OLD Includes both multi-year and second-year ice. Generally 2-3.5m thick.
FY Any or all first year ice types (30 cm - 2 m thick).
YNG Young ice (10-30 cm thick).
N New and nilas.
Fast ice. Sea ice which forms and remains fast along the coast.
120 Theoretical thickness of this season's growth (cm), based on freezing degree days (presented for first day of each month on first succeeding chart).
Ice boundary visually or satellite observed.
Ice boundary estimated.

Figure 33.--Bering Sea and North Slope ice analysis, January 1981.

Two West Coast panels show the monthly maximum seaward extent of coastal upwelling zones that could be observed in enhanced satellite imagery. Other thermal features, such as key fisheries isotherms, may be shown. A short descriptive text summarizes monthly trends in these features, and attempt to correlate them with causative environmental factors. Two East Coast panels show positions of the Gulf of Mexico's Loop Current and the Gulf Stream. Also shown, will be associated eddies and their monthly movements, with a short descriptive text much like the present page 2 analyses in gulfstream magazine. Regional areas for the hand-drawn analyses are:

Bering Sea/ North Slope	55°N-75°N	180°W-140°W
West Coast/ North	42°N-51°N	135°W-122°W
West Coast/ South	20°N-42°N	130°W-110°W
East Coast	25°N-45°N	83°W-55°W
Gulf of Mexico	15°N-35°N	100°W-80°W

All present subscribers to both gulfstream and Fishing Information will automatically be included on the new Oceanographic Monthly Summary mailing list. The subscription price for paid subscribers will be recomputed by the Government Printing Office. Further information on this will be given in future issues of Oceanographic Monthly Summary. Any additional inquiries can be directed to the gulfstream editor.

The Editor for Oceanographic Monthly Summary will be the present gulfstream Editor, Steve Auer. NWS' Ocean Services Group at National Meteorological Center has done the software development for computer analyses and the new climatology, and will run the monthly analyses. NOAA's Office of Management and Computer Services assisted in graphics software development. Hand-drawn analyses and text will be contributed by NWS and NESS analyses, and NESS will also assist in production.

BAD START TO 1981 FOR OVERDUE VESSELS

Four vessels were posted missing by Lloyd's February 18 putting figures for the start of 1981 among the worst ever for the period.

In all four cases bad weather is thought to have been the cause of the ships being overdue, and Lloyd's called for information on the vessels before they were finally posted missing.

In three of the cases: the Greek 24,527-ton deadweight ANTIPAROS; the reported Panamanian 6,597-ton DON AURELIO; and the Yugoslav 25,200-ton DUNAV, were all last reported in the Pacific between the end of December of last year and the beginning of January. One of the vessels was carrying scrap iron while the other two had cargoes of steel products.

The fourth ship, the West German cargoship RUGWARDERSAND 1,596-tons gross was last reported in the Mediterranean after leaving Leghorn on January 5 for Annaba with a cargo of flour in bags.

The number of overdue ships so far this year is higher than the corresponding period last year, although the number of casualties so far is slightly down from the corresponding period in 1980.

BUOY ADRIFT

Buoy 6N9, adrift from station 44002 off the New Jersey Coast, was approximately 1,000 mi east-southeast of Cape Cod the first week of December 80. The buoy went adrift around October 1 and retrieval operations were attempted by the USCGC CHILULA November 8. Due to high seas, a tow line could not be secured to the buoy and subsequently, the vessel was directed on a law enforcement mission. Buoy positioning data was requested on an emergency status. When a vessel is available, the buoy will be retrieved. As of February 9 the buoy had not been retrieved and was near 38.6°N, 53.9°W.

ATLANTIC STORM PROVIDES DATA ON OCEAN WAVES

A destructive Atlantic storm that occurred during a major international experiment being co-sponsored by NOAA has provided exceptionally important information about ocean waves and systems for measuring them.

The field information collected off North Carolina's Outer Banks during the 3 day storm that began October 23 provided valuable information for improving basic theories of wave propagation, growth and dissipation.

The storm occurred midway through the 2 mo Atlantic Remote Sensing Land Ocean Experiment (ARSLOE) sponsored jointly by NOAA and the U.S. Army Corps of Engineers.

ARSLOE was an unprecedented ocean wave experiment involving more than 100 scientists from 5 Federal agencies, 10 universities and 4 foreign nations. Using bouys, ships, aircraft, satellites, bottom and shore-based stations, the researchers recorded wave conditions during October and November within a 40 km radius of the Corps field research pier at Duck, North Carolina.

Units of NOAA's National Ocean Survey, Environmental Research Laboratories, Environmental Data and Information Service, National Weather Service, and Office of Technology and Engineering Services participated in the project. The NOAA research vessel, LAIDLY, provided logistics support offshore throughout the project.

The entire experiment was considered a success. Particularly important was the data gathered during the October storm.

The principal organizer of ARSLOE, reported that 90 percent of the 145 data collection instruments were "up", or working, during the storm. Seventy percent, is considered a good average for such a complex experiment.

The primary goals of ARSLOE were to compare various types of instruments that measure wave characteristics - height, direction, period and frequency - and to compare remote sensing techniques against surface gear.

ARSLOE not only allowed NOAA and the Corps to evaluate most instruments and techniques now available, but also enabled the agencies' scientists to gather important wave data sets that can be used to improve mathematical models for forecasting sea conditions in shoal waters.

While field work for ARSLOE concluded November 30, NOAA's Wave Propagation Laboratory continued

radar experiments for an additional 2 wk. Many bouys will remain to measure waves all winter.

ADDENDUM

Acknowledgment to Coastal Oceanography and Climatology News was inadvertently not included in two items used in "On the Editor's Desk" of the January-February 1980 issue (Vol. 25, No. 1). One was "Satellite Shows Record Diameter Warm Core Eddy off Hudson Canyon" by Jayne L. Fitzgerald and R. Wylie Crist of the Atlantic Environmental Group, National Marine Fisheries Service, Narragansett, R.I. The other item was "Aircraft Measures Wind Fields off Washington Coast" by James Overland, Pacific Marine Environmental Laboratory, NOAA, Seattle, Wash.

WEATHER MESSAGES VIA AMVER

The U.S. Coast Guard's Automated Mutual-assistance Vessel Rescue (AMVER) System occasionally receives messages via MARISAT from vessels wishing to file weather reports with the National Weather Service in Washington, D.C. These messages are addressed OBS METEO WASHINGTON DC.

Ships making OBS METEO reports via MARISAT may send them directly to Washington via either TELEX or TWX. The TELEX number is 89-406. The TWX number is 710 8279675. Direct transmission of these messages will eliminate the need for AMVER to refile them and will ensure the timely delivery and maximum usefulness of the reports.

LETTERS TO THE EDITOR

NEW FORMAT FOR THE NEW YORK HARBOR FORECAST

The following information about the new format for the New York harbor forecast was provided by New York Forecast Office of the National Weather Service.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
30 Rockefeller Plaza
New York, New York 10112

January 7, 1981

To: E. Wilson
Mariners Weather Log

From: Jim Allen
IMIC, WSFO-New York, NY

Subj: New Format for the New York Harbor Forecast

Historically, the New York Harbor Forecasts were issued in the narrative form to provide assistance to the marine community in shaping up their stevedoring work force, also for docking and towing procedures. While this service was more than adequate, there was a growing desire among users to have a product with more emphasis on the weather during the daytime working hours.

During the fall of 1979, Mr. James Travers an Regional Marine Meteorologist, along with WSFO New York meteorologists and the Maritime Association of the Port of New York developed a matrix form (see attached) for the Harbor Forecast. Listed below are some of the principal features of this format:

1. Provides a forecast with more detail while using about 30 per cent less alfa-numerics.
2. Emphasis is placed on the daytime portion of the forecast by dividing the day into morning and afternoon.
3. It gives a bird's eye view of each forecasted parameter.
4. A forecast product which is very easy to update or amend by inserting new values under a fixed heading.

The new format of the New York Harbor Forecast has been well received by users.

Attachments

NEW YORK HARBOR FORECAST
NATIONAL WEATHER SERVICE NEW YORK NY
430 AM EST TUE DEC 30 1980

	WINDS KTS	PCPN PROB	TEMP F	TIDE FT	VSBY MI
TODAY 6 AM TO NOON	N 20G	20	43	1 ABV	5+
NOON TO 6 PM	N 20G	10	38	1 ABV	5+
TONIGHT	N 18G	0	23	NML	5+
WEDNESDAY 6 AM TO NOON	N 13	0	28	NML	5+
NOON TO 6 PM	NE 10	10	32	NML	5+

REMARKS...SMALL CRAFT ADVISORY REMAINS IN EFFECT.
MOSLY CLOUDY TODAY BUT WITH A FEW SUNNY INTERVALS BY AFTERNOON. CLEARING TONIGHT AND WEDNESDAY.

TCM

NEW YORK HARBOR FORECAST
NATIONAL WEATHER SERVICE NEW YORK NY
4.30 PM EST SUN JAN 4 1981

	WINDS KTS	PCPN PROB	TEMP F	TIDE FT	VSBY MI
TODAY 6 AM TO NOON	NW 25+	0	7	1 BLO	5+
NOON TO 6 PM	NW 25+	0	19	2 BLO	5+
TONIGHT	NW 1R	0	R	1 BLO	5+
MONDAY 6AM TO NOON	NW 15	0	15	NML	5+
NOON TO 6PM	NW 10	0	29	NML	5+

REMARKS...SMALL CRAFT ADVISORY REMAINS IN EFFECT...
SUNNY WINDY BITTERLY COLD TODAY, FAIR TONIGHT AND MONDAY. SOME FREEZING SPRAY TODAY WITH THE VERY LOW TEMPERATURES.

MW

EARTHQUAKE REPORT

The following report of an earthquake at sea by the crew of the WALTER RICE was forwarded by the Seattle Port Meteorological Officer, Don Olson. According to Mr. Von Hake of the National Geophysical and Solar-Terrestrial Data Center at Boulder, Colorado the earthquake occurred at 1027:33 November 8, 1980. The epicenter was at 41.14°N, 124.30°W with a depth of focus of 14 km. The magnitude was 7.0. There was damage to Eureka, Cal and five people were injured.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
1700 Westlake Avenue North
Seattle, Washington 98109

Date November 25, 1980 Reply to Attn. of:

To Editor, Mariner's Weather Log
Mr. E. E. Wilson

From PMO Seattle, Don Olson

Subject: Earthquake report from the SS WALTER RICE

On November 12, 1980 during my routine visit to the SS WALTER RICE at Longview, Washington, Captain D. Hoobler mentioned they had experienced a seismic tremor off the California coast on the morning of November 8th. The Captain indicated that this was his first experience with an earthquake at sea. At the time of the occurrence they had no idea what had happened. Their first thought was that they had run aground; then another possibility was damage to the shaft or propeller from debris. After some careful procedures in restarting propulsion with no apparent damage they proceded on course towards the Columbia River. Not until an hour or more did they determine they were within some twenty miles of the epicenter of the quake from reports from a radio station in Eureka, Ca.

The SS WALTER RICE is a bulk carrier chartered to Reynolds Aluminum Company to haul alumina ore from Texas to the Reynolds plant in Longview, Wa. They make the round-trip in about two months..

The ship originally was built as a tanker in Chester, Pa. in 1945; then converted in 1963 to a bulk carrier. The Captain and the ship's officers have always done an excellent job of weather reporting for these many years.

The WALTER RICE is classified a SELECTED SHIP in the Cooperative Ship Weather Observation Program. The ship is supervised by the Houston, Texas Port Office.
Attached report from the Captain and ship's officers, SS WALTER RICE.

REYNOLDS ALUMINUM

To: National Weather Service

Subj: seismic tremor off California Coast 8 November 1980

S.S. Walter Rice enroute Balboa,Panama to Longview,Washington with load of alumina ore at Lat 41-16.2 N Long 125-17.1 W(position by loran "C" and satellite navigator) Saturday 8 November 1980,1028Z.Mate on Bridge watch B.Fitzgerald and Engine Room watch officer G.Dustin 3/AE.

At 0228 (LT) vessel experienced excessive vibration and 3/O Fitzgerald rang up stop on engine order telegraph.The vibration was so severe that all on board were awakened.The Master,Chief Mate and 2/nd Mate went immediately to the bridge as the Chief Engineer,1/st Assistant and 2/nd Assistant went to the engine room. Chief Engineer A.Konselman found main generator excitation breaker tripped out. No apparent cause other than vibration was found.breaker reset and main engine engaged.Resumed passage at 0316(LT).

At 0400 received word over marine radio of earthquake.Position given for epicenter was plotted.Time of quake 1028Z coincided with stop bell.Epicenter found to be 22 miles north of our 1028Z position.

D.Hoobler — Master
A.KONZELMAN — Chief Engineer
J.GIBNEY — Chief Mate
M.KRIDER — First Assistant
T.Buckley — Second Mate
E.Imhoff — Second Assistant
B.Fitzgerald — Third Mate
G.Dustin — Third Assistant
E.Plummer — Third Mate
C.Edwards — Third Assistant

REYNOLDS METALS COMPANY · MARINE DIVISION · P. O. BOX 2311 · CORPUS CHRISTI, TEXAS 78403
PHONE: 512/883-3841 CABLE ADDRESS: REYMAR TWX NUMBER: 910/876-1486

MARINE WEATHER REVIEW

The Smooth Log (complete with cyclone tracks, climatological data from U.S. Ocean Buoys, and gale and wave tables) is a definitive report on average monthly weather systems, the primary storms which affected marine areas, and late-reported ship casualties for 2 mo. The Rough Log is a preliminary account of the weather for 2 more recent months, prepared as soon as the necessary meteorological analyses and other data become available. For both Smooth and Rough Logs, storms are discussed during the month in which they first developed. Unless stated otherwise, all winds are sustained winds and not wind gusts.

Smooth Log, North Atlantic Weather

September and October 1980

SMOOTH LOG, SEPTEMBER 1980--This was a busy month for extratropical cyclones across the North Atlantic between latitudes 45° and 55°N in the west to latitudes 55° to 65°N in the east. Over North America the storms were farther north than normal. There were storm tracks from north of Lake Winnipeg to the

Davis Strait; eastward over the northern Great Lakes to Nova Scotia then towards Ireland; and another from Labrador toward the Faeroe Islands. Only one storm traveled up the U.S. East Coast (in the last week of the month), where there is normally a primary track.

The sea-level pressure pattern was a close match with climatology, but pressure centers were more intense. The 1000-mb Icelandic Low was near 60°N, 27°W, about 150 mi southeast of its 1005-mb climatic counterpart. The Bermuda-Azores High was 1026 mb near 37°N, 32°W, 5 mb higher and 200 mi north of its 1021-mb climatic mate. A tongue of high pressure 4 mb higher than normal stretched across southern Europe to the Black Sea. The pressure over the eastern United States was from near normal to plus 2 mb east of Cape Hatteras (fig. 34).

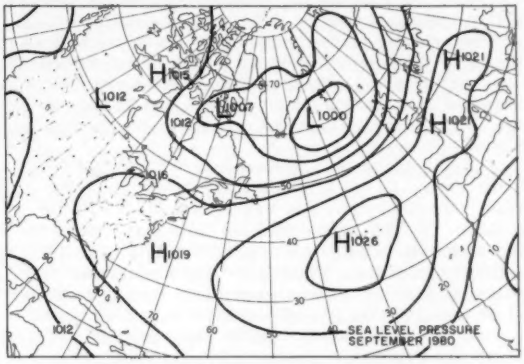


Figure 34.--Mean sea-level pressure.

There were two major pressure anomaly centers. A minus 6 mb was centered near 59°N, 27°W, and a plus 5 mb was centered near 40°N, 24°W. In general the pressure over Europe ranged from 3 mb over normal over Italy to 5 mb over Finland.

As usual the upper air flow was near zonal between 40°N and 55°N latitude. The usual 700-mb trough over Baffin Bay and the Labrador Sea was split into two troughs, one over the Foxe Basin and the other about 35°W longitude. The trough off Portugal and North Africa was deeper and sharper than usual.

September is usually the month with the most tropical cyclones, and this month was normal. There were five, two tropical storms and three hurricanes. They were Danielle, Earl, Frances, Georges, and Hermine.

Extratropical Cyclones--A quick summary of the month indicates the Bermuda-Azores High well established along latitude 35°N with the cyclone track between latitude 50° and 60°N. The second week the High moved eastward over the Azores with the cyclones continuing along 55°N. During the third week the High spread eastward from the Azores into Europe. The cyclones over the western ocean shifted southward as far as latitude 45°N. A significant HIGH moved out of Canada and over the western waters. The fourth week the high pressure was back to normal along 30° to 35°N, and the major LOWs were near latitude 60°N.

This first significant storm of the month developed south of James Bay late on the 1st. It deepened as it moved over the Gulf of St. Lawrence on the 3d, and the first gales were reported. A Bahamian vessel in Cabot Strait radioed a report of 52-kn winds. The stern trawler MARIA TEIXEIRA VILARINHO was blown aground at 53°27'N, 55°46'W. The crew was rescued by the TAVERNER. The vessel had almost 1 million pounds of fish aboard. Apparently, the vessel lifted anchors to move offshore but lost power and was blown onto rocks at about 0600 on the 4th. Efforts to free the vessel failed and she was abandoned.

At 1200 on the 4th the 980-mb storm was near 53°N, 50°W. The SIR ROBERT BOND at 50°N, 55°W, had 45-kn northwesterly gales. Later the MANCHESTER RENOWN west of the center had 44-kn winds, 23-ft seas, and 30-ft swells. On the 5th a ship near 47°N, 49°W, had 48 kn, and the GULF SHIPPER (49°N, 42°W) had 45-kn winds with 13-ft seas. On the 6th the waves increased to 23 ft. The C.V. STAGHOUND had 35-kn gales and 20-ft waves near 50°N, 32°W. Late on the 6th, another center developed to the northeast of the first one. There were a few gale reports on the 7th, and the VULCANUS in the North Sea had 47-kn southerly winds. By the 8th the original LOW had disintegrated.

This was the extratropical version of hurricane Georges. At 1200 on the 8th he was listed as a 75-kn hurricane, but 12 hr later the cold environment had transformed the storm into a 992-mb extratropical LOW near 50°N, 43°W. The storm passed north of OWS Charlie at 1200 with 40-kn winds and 21-ft seas. The GENERAL JASINSKI at 55°N, 30°W, was due east of the storm with 48-kn southerly winds. On the 10th the CAST TERN (48°N, 28°W) found the winds to be 50 kn. The FALCON (54°N, 24°W) had 44-kn winds and 20-ft seas. OWS Lima reported 25-ft swell waves. Late on the 10th the storm passed over the North Sea with gales. It continued moving inland.

The next storm was also the remains of a hurricane--Earl. Earl was still considered a tropical storm as he crossed 51°N, 25°W, at 0000 on the 11th while embedded in an extratropical cyclone. By 1200 the two cyclones had merged. Three ships, none of which were listed in the July 1980 edition of AMVER ships, reported winds of over 50 kn. Lima measured 44-kn winds and 15-ft waves. On the 12th the 972-mb storm was over Pentland Firth. Gales up to 45 kn and waves up to 20 ft were found mainly over the North Sea. The AMERICAN RACER near Inishtrahull Island had westerly gales of 45 kn and waves of 20 ft. The SHETLAND SHORE, at 56°N, 02°E, had 50-kn winds and 25-ft waves at 1800. The number and speed of the gale observations decreased as the storm moved over Scandinavia.

This storm can be traced to the eastern slopes of the Canadian Rocky Mountains on the 6th. It traced a sinusoidal curve across Canada with a negative slope as it plunged from Hudson Bay to the Gulf of St. Lawrence. At 1200 on the 12th the storm was 994 mb east of Anticosti Island. Gales were reported over Cabot Strait, and SEDCO measured 38 kn on the 13th. An American ship had 40 kn on the 14th near 47°N, 49°W. By 1200 on the 15th the storm was 978 mb near 57°N, 27°W. OWS Charlie measured 41-kn winds and 20-ft seas. The circulation was as far north as Iceland and bringing winds over 40 kn to the fishing fleet. The ZINNIA and DORDRECHT were south of the center with winds

of 40 kn and waves up to 25 ft. The LOW was weakening on the 17th, but it managed to survive until it was over Nordkapp on the 18th.

Monster of the Month--This was another long-lived storm that tracked nearly one-third of the way around the world. It was born on the high plains of Montana on the 11th. It traced a nearly straight rhumb-line track along 45°N, passing over the Great Lakes on the 13th and 14th and reaching Nova Scotia on the 15th. The storm intensified as it crossed the Grand Banks. At 1200 on the 16th it was 992 mb near 48°N, 46°W. The ATLANTIC CONVEYOR had sailed through the cold front a few hours earlier and now had 45-kn westerly winds with 25-ft waves on her bow. The AMERICAN ARGOSY, about 200 mi southeast of the center of the storm, had 50-kn southwesterly winds with 13-ft seas and 25-ft swells. The storm was 972 mb at 1200 on the 17th. Several ships had winds near 50 kn and waves up to 20 ft. The AMERICAN LEADER had only 40-kn winds near 48°N, 35°W, but the waves were 30 ft. The DORDRECHT now near 54°N, 31°W, suffered 60-kn winds and 23-ft waves. At 1800 two ships, including the ZINNIA, had 60-kn winds and 38-ft waves. The TURANDOT found 36-ft waves.

Twenty-four hours later at 1200 on the 18th the 972-mb storm was near 54°N, 15°W. Many ships had bridgeshaking winds and waves. The ARMADALE was the hardest hit with 49-ft waves and 55-kn winds near 48°N, 21°W. Other ships with winds over 50 kn and/or waves over 30 ft were the CINULIA, C.P. VOYAGEUR, DART CANADA, and SEATRAIN SARATOGA. OWS Romeo had 26-ft seas. On the 19th the SEATRAIN SARATOGA (49°N, 19°W) had 46-ft waves near the ARMADALE, which still had 49-ft waves. Romeo and a ship were calling the waves 26 ft.

The storm had started curving southward on the 19th and the pressure began rising. At 0600 on the 20th an area of great instability must have passed Romeo as she reported 64-kn northerly winds with 26-ft seas. The storm moved to near La Coruna on the 21st, then it started back-tracking and was absorbed by the next storm.

This frontal wave formed very near the weather station on Sable Island on the 19th. Hurricane Frances was to the east. On the 20th the wave passed very near SEDCO, which measured 40-kn winds and 16-ft seas. On the 21st Frances was a small tropical storm embedded in the extratropical circulation. There were many gale and high-wave reports this day. Frances was absorbed by 1200. The GETAFIX was in the southwest quadrant about 300 mi from the center where quite often some of the worst weather occurs. She had 70-kn winds at 1200 with no waves reported and 63 kn with 33-ft swell waves at 1500. Charlie measured 50-kn winds and 26-ft waves.

As the 22d dawned the LOW was moving northward. The CARCHESTER (49°N, 29°W) was sailing westward at less than 5 kn and had been having 30- to 40-ft waves for over 6 hr. The ARMADALE and Charlie were still having 28- to 33-ft waves. By 0000 on the 23d the CARCHESTER was encountering only 23-ft waves at 49°N, 31°W. The LOW was now 972 mb about 200 mi east of Kap Farvel. The storm was filling rapidly and shrinking.

This storm had a rather complicated origin. A storm center moved south of Hudson Bay on the 22d. That day a ship believed to be the KEEWATIN was near Churchill on Hudson Bay and reported 44-kn bone-chilling northerly winds. The ship was sailing out of the Bay and the winds dropped to 37 kn on the 24th as the LOW moved northeastward. This storm moved over Baffin Island, and two other LOWs formed at the point of occlusion and over the Labrador Sea on the 25th. Several ships had gales over the Labrador Sea.

A Netherlands ship off Hopedale radioed that they were having 65-kn winds and 20-ft waves on the 25th. An American ship nearby had 43 kn with 16-ft seas. By 1200 on the 26th the LOW that formed at the occlusion was 978 mb near 60°N, 30°W, and the center of attention. There were quite a few gale reports, and OWS Charlie measured 45-kn winds with 25-ft seas. On the 27th the ARCTIC was near Kap Farvel with 58-kn winds. LIMA reported only 35 kn just prior to passage of a trough line. On the 28th the storm was northeast of Iceland and headed for the Arctic.

The Great Lakes nursed this storm. It formed over Wisconsin and fed off the warm water of the Lakes. On the 26th, the JOHN DYKSTRA on Lake Huron measured 44-kn westerly winds with 5-ft waves, and the LEON FRASER on Lake Superior measured 45-kn northerly winds with 8-ft waves. By 0000 on the 27th the storm was over the northern border of Maine. The NOVO MESTO (40°N, 61°W) and SEDCO (47°N, 49°W) both had 50-kn winds. On the 28th the 980-mb storm was approaching the Denmark Strait. The BORRUYSK (57°N, 22°W) had 37-kn winds but 30-ft seas, while OWS Lima at longitude 2°E had 42-kn winds and 18-ft seas. The storm moved over Iceland on the 29th. In the southerly flow, the SMIT LLOYD 9 and the GTOT both had 50-kn winds near the Orkney Islands. OWS Mike measured 42-kn winds, while Lima had 20-ft seas. Gales were still blowing as the storm moved into the Barents Sea.

This storm came out of Labrador. It was over the Labrador Sea on the 29th at 1005 mb. Some Canadian ships were reporting gales. By 1200 on the 30th the storm was 986 mb east of Kap Farvel, and the front was well past Charlie, leaving 45-kn winds and 20-ft seas. At 1800 the swells were 25 ft. Lima reported 50-kn winds. At 0600 on October 1 the winds hit 58 kn and the waves 36 ft. At 1200 there were many reports over 40 kn generally east of longitude 20°W. On the 1st and 2d the ship listing was saturated with gale or higher reports over the North Sea. The VULCANUS ap-

peared to take the high-wind award with 68 kn at 54°N, 04°E. The ABBEY (59°N, 20°W) had the highest waves of 39 ft. By the 3d the storm was over the Gulf of Bothnia and much subdued.

Tropical Cyclones--The annual article describing 1980 tropical cyclones can be found on page 79.

Casualties--There were three collisions involving six vessels in fog over the Kiel Canal and Helsingborg on the 5th. The URSULA and CAROLA, the ATKARSK and MERAN, and GABBRO and SZCZECIN TRADER were involved. All damage was light. The CLYMENE rescued a yachtsman from the 50-ft yacht JEANTEX about 700 mi northeast of St. John's, Newfoundland, on the 16th. A Canadian Armed Forces aircraft spotted the man with signals from an emergency locator transmitter. There were more fog and collisions on the Kiel Canal on the 23d and 24th. They involved the ZUIDWAL with the KONIN and the ENRICO BERLINGIERI with the LADOGA. These vessels reported heavy damage. The CUPID arrived Montreal on the 29th with wet sugar from hatch leakage during heavy weather.

Other Casualties--The AGIOS IOANNIS broke mooring cables and suffered other damage during heavy swell on the 6th at Sepetiba, Argentina.

SMOOTH LOG, OCTOBER 1980--There were near the normal number of significant storms this month. The storm paths did not closely follow the climatological pattern. A path from the Great Lakes into the Davis Strait did not exist. The most heavily traveled track was from James Bay to Iceland. There was also a track from off the U.S. East Coast to the central ocean south of Iceland. As the storms approached or were over Europe, they crisscrossed in all directions.

The overall configuration of the Icelandic Low was normal, resembling a boomerang, but the elbow was shifted from the primary 1001-mb center south of the Denmark Strait to a 1004-mb low center over Scandinavia. There were four 1004-mb and one 1003-mb centers. The 1021-mb Azores High was near 29°N, 43°W, about 600 mi southwest of its usual position (fig. 35).

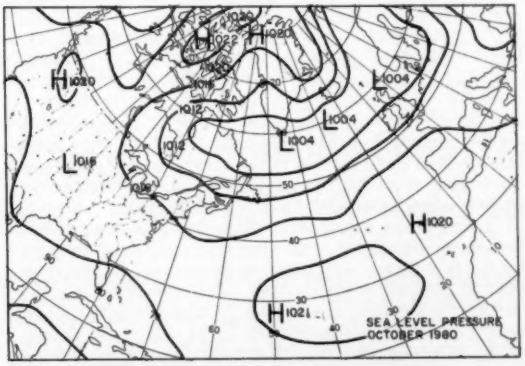


Figure 35.--Mean sea-level pressure.

The sea-level pressure departures over water were minor, except over northern waters. There was a plus 10-mb anomaly center over the Denmark Strait, and another over Cornwallis Island on the Northwest Passage. The major negative anomaly was 8 mb over southern Sweden.

The center of circulation in the upper air pattern at 700 mb was shifted from northern Ellesmere Island to south of Hudson Strait. This sharpened and tightened the trough near eastern North America. The flow over water between latitudes 35° and 55°N was zonal and stronger than normal. There were negative height anomalies over eastern Canada and northern Europe.

Hurricane Ivan was the only tropical cyclone this month.

Extratropical Cyclones--A frontal system stalled along the East Coast on the 3d as several waves formed and moved northeastward. On the 0000 chart of the 4th a frontal wave formed and persisted as it moved northeastward. The storm raced northeastward and by 1200 on the 6th was near 66°N, 20°W, at 975 mb. At this time several ships reported winds over gale force. Among them were the MANCHESTER CRUSADE (55°N, 16°W) with 44-kn winds and 23-ft waves and the STEFAN BATORY (54°N, 29°W) with 40-kn winds and 25-ft seas. By 0000 on the 7th the pressure had dropped to 958 mb and the storm was churning the waters east to Greenland and south to Spain (fig. 36). Many ships and platforms were receiving winds up to 50 kn. The ARCTIC TROLL (49°N, 6°W) had 20-ft swell waves. An Icelandic ship near 64°N, 12°W, had 60-kn winds from the north.

The many reports of high winds continued through the day and at 1800 the ANCO EMPRESS (51°N, 07°W) had 41-ft waves and the ATLANTIC PROSPER (48°N, 12°W) had 46-ft waves. On the 8th the storm stalled near 64°N, 05°E, and the pressure was as low as 954 mb. Winds up to 50 kn and waves to 25 ft continued to whip the ocean surrounding the British Isles. On the 9th the storm was weakening and splitting into other centers.

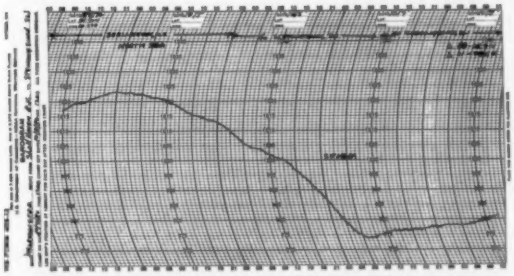


Figure 36.--Barogram aboard the MORMACSTAR as she sailed across the North Sea.

This storm originated about 600 mi east of Long Island on the 6th. It crossed Trinity Bay on the 8th and caused no great disturbance until the 9th, when it started to intensify. At 1200 the pressure was 996 mb. At 1800 a Soviet ship had 50-kn winds and 23-ft waves slightly north of the center. The SEALNES found 54-kn winds on the 10th. The AMERICAN ARGOSY (51°N, 21°W) and OWS Romeo both fought 20-ft waves. The TERTRE ROUGE on the North Sea had 56-kn winds out of the south. On the 11th two ships south of Lands End had 50-kn winds with one having 30-ft seas. The storm crossed the English Channel and continued southeastward.

Monster of the Month--The cold, north country west of Churchill, Canada, produced this storm on the 7th. By the 9th the storm was over Quebec Province and quite large. The northerly flow west of the center brought a record cold 22°F to Sault Ste. Marie. A ship on Hudson Bay had 54-kn northerly winds on the 10th. There were several ships with 50-kn winds on the 11th. The WALTHER HERWIG near 61°N, 35°W, had 23-ft waves. Hurricane Ivan was moving northward in the warm sector of the storm. By the 12th he was extratropical, and at 1200 brought 60-kn winds and 31-ft seas to OWS Lima just prior to passing over her position. The waves were still 26 ft at 1800. The two LOWs combined on the 13th, and the ARNI FRIDRIKSSON found winds over 50 kn near 63°N, 18°W, north of the center. Winds in the 40-kn category continued on the 14th with Romeo reporting 25-ft seas.

The storm was moving southward on the 14th, but it turned northeastward on the 15th while over the Bay of Biscay. The TROLL PARK was west of the center with 44-kn winds and 23-ft waves. The GULF SHIPPER was sailing eastward into the storm. She had 40- to 50-kn winds from 1800 on the 13th to 0600 on the 16th with waves up to 21 ft. The storm brought winds over 40 kn to the North Sea on the 17th. The FENGTIEN was on the Bay of Biscay with 44 kn and 26-ft waves. The storm was centered near Oslo on the 18th and many reporters had winds near 50 kn and waves near 25 ft. The BALTIC VALIANT near 55°N, 02°E, found 33-ft waves. On the 19th the winds and waves died down as the storm moved northward into the Barents Sea. The following ships had problems during this storm. The 500-ton Irish ARKLOW BRIDGE was shipping water in heavy seas off Whitby High lighthouse on the 17th and 18th. The SIRIUS encountered heavy weather on the 18th in the North Sea and the cargo shifted. Three Russian ships, the PIONEER BELORUSSII, VASILIY POLENCO, and MITROFAN GREKOV, in the North Sea encountered heavy weather and their cargoes of wood shifted. All took refuge in Norwegian ports on the 19th. The GIANNA A., anchored off Stavanger because of heavy weather, caught an electric cable when weighing anchor. The Greek SKYRIAN HOPE sank off northern Spain after the steel beam cargo shifted in heavy seas on the 20th.

The central ocean produced this storm. It was 997 mb at 1200 on the 18th. The LONDON BARON was 180 mi southwest of the center with 52-kn winds and 13-ft waves. As the storm traveled northward, another LOW from Nova Scotia moved into the southern part of the circulation. They traveled northward as a pair. The EXPORT LEADER (49°N, 37°W) found 50-kn winds, 23-ft seas, and 36-ft swells west of the center. Other high winds were in the strong gale range with waves up to 25 ft. The second LOW disappeared on the 20th and this one on the 22d. Prior to that though, the BAMSA DAN at 59°N, 18°W, had 51-kn winds and 30-ft seas out of the east.

This was a very long-lived LOW, which survived the last two weeks of the month. It became very weak at times, but it was still identifiable. The storm formed over the Great Basin in Nevada and traveled to Hudson Bay, where it made a cyclonic loop on the 19th and 20th. As it passed north of the Great Lakes, it deposited rain in that basin. It then traveled to the Maritime Provinces by the 22d as a weak depression.

East of St. John's the storm picked up strength from the warmer water and had a large circulation by the 24th. Some gales were now blowing. The LACKENBY (47°N, 51°W) ran into 45-kn winds and 23-ft swell waves at 0600. By midday on the 25th the storm was 966 mb and stretched from Cape Race to Ireland and Iceland to 35°N. There were 19 reports of winds of 40 kn or greater. Six of them were from ships of American registry. The LACKENBY (46°N, 46°W) had 55-kn winds and waves of 33 ft. The AMERICAN LEGEND (48°N, 29°W) found 45-kn winds and 29-ft waves. At 1800 the AMERICAN ACCORD (49°N, 39°W) reported 56-kn winds driving 46-ft seas. Her high winds and waves continued into the 26th, when she reported 41-ft waves at 1200. Several ships had 60-kn winds in the northwesterly flow. The storm deteriorated rapidly on the 27th and crossed north of Scotland and into Norway and then into Russia. The storm had traveled from longitude 115°W to 45°E.

On the 23d there was a large 1039-mb HIGH centered between Lake Huron and James Bay. Northeasterly winds of 10 to 30 kn were blowing off the Carolina coast north of a stationary front stretching east-west across Florida. A weak frontal wave moved across Florida and was off Jacksonville on the 0000 chart of the 24th. Late on the 23d the BARBER PERSEUS was sailing northeastward along the Gulf Stream. At 1900 she reduced speed due to heavy weather. At 2220 at 31°21'N, 78°56'W, on a course of 41°, she was hit by a freak wave which damaged containers on the deck of the 21,747-ton vessel. At the time the weather was: wind NE 7, barometer 1014.8, wet bulb temperature 24°C, dry bulb temperature 25°C. The following was extracted from the ship log: "We hit a twin freak wave--went over the top of the first one and down the other side straight into the second wave, which completely engulfed forward section of the ship. The ship at the time was doing about 10 kn but was stopped by the wave completely. The sea was increased in size by the fact that it was completely opposed by the current of the Gulf Stream. The wave caused extensive damage to forward containers on deck. Approximate height of containers above sea level was 62 ft. None of the ship's structure was damaged as the wave carried over the top of the forecastle."

This frontal wave was first analyzed late on the 28th south of Cape Sable. It moved rapidly northeastward and was south of Cape Race at 1200 on the 29th. The

CG26 near 44°N, 64°W, had 47-kn northwesterly winds. By 1200 on the 30th the storm was 976 mb near 57°N, 32°W. The higher winds and waves were east of the center. The MANCHESTER CONCORDE (56°N, 29°W) was hit by 52-kn winds driving 25-ft seas and 33-ft swells. Nearby the KING WILLIAM had 60-kn winds, but the waves were only 20 ft. Behing the cold front at 45°N, 44°W, the IXIA had 40 kn with seas of 20 ft and swells of 25 ft. Lima had 47-kn winds and 23-ft waves at 0000 on the 31st. At 0600 she measured 59 kn and 30-ft waves. Many ships were reporting gale to storm winds with waves as high as 33 ft that day. The storm was now moving due north, but on November 1 it turned northwestward and made a loop south of the Denmark Strait. Most of the high winds were now east of the front which paralleled longitude 10°W. An exception was the JUTHLANDIA near 59°N, 32°W, with 50 kn. On the 2d the weakened storm raced northward through the Denmark Strait.

Tropical Cyclones--Out of a nontropical LOW in the eastern North Atlantic came hurricane Ivan on the 5th. Spawned some 500 mi south of the western Azores, the storm headed southward then swang west-northwestward on the 7th. Ivan was of hurricane strength from the 6th through the 11th. Peak winds were estimated at about 85 kn on the 9th and 10th as Ivan headed north-northeastward. He passed about 350 mi west of the westernmost Azores on the 10th. The SNOW STORM was only 60 mi east of the eye at 0900 with 55-kn winds and 17-ft seas and swells. They were very lucky with good seamanship as snow storms very seldom survive a tropical storm. Accelerating to a 40-kn forward speed, Ivan merged with a cold front in northern waters on the 11th. The HIJAZ from Jeddah to New York reported running into Ivan on the 10th and losing 56 containers overboard.

Casualties--Twenty-two people were rescued from the burning 4,640-ton Swedish FINNEAGLE by helicopters in 65-kn winds and 25-ft waves. The ship, loaded with carbide, had run out of fuel about 70 mi northwest of Orkney. The 560-ton LUGELA and the 304-ton JAQUETON collided in fog 5 mi north of Cape Finisterre on the 5th. The GARDNO sprang a leak in heavy weather off Norway on the 7th. The 300-ton Danish RANDI DANIA capsized in heavy weather off Corunna on the 7th while trying to assist the British yacht BARTHOLOMEW TIFFING. Four of the crew of six were rescued. The Greek bulkcarrier MEDSTAR (11,082 tons) encountered heavy weather on the 7th to 10th on voyage from Florida to Italy.

The SEA CARRIER I grounded in high winds inbound to the port of Colchester on the 9th. On the 10th a seaman was rescued from the crew quarters of an overturned barge towed by the tug CRAIGLEITH off the Isle of Wight. He survived for 2 hr in an air bubble. Early on the 11th the trawler ELODIE capsized in 80-kn winds off St. Nazaire, France. Two of six crewmen were rescued and two more of three trapped inside the hull for 36 hr were rescued by divers. In the same area an 8,000-ton vessel being towed to a scrapyard snapped the tow line.

On the 13th the 1,000-ton gas tanker GAZ EAST sank in high winds off the south coast of France. All 15 aboard were rescued. The tank barge TORDUCT grounded in fog off Essex. The LASH barge CG-170 arrived Bilbao with weather damage. A fire aboard the Italian MADDALENA LOFARO may have been caused by sparks generated by the movement of cars in hold during heavy weather. The Greek bulkcarrier AEGIS PROGRESS sustained heavy-weather damage during October 14 to 17 from the Suez Canal to Szczecin.

On the 15th the AMYNTAS and the SILVER STAR contacted in a rain storm in the outer anchorage of Cristobal. The ferry WANDS BEK and the tug BAHIA collided in fog near Hamburg.

The Liberian bulkcarrier NAVIOS PATRIOT suffered weather damage on a ballast voyage from Setubal to Port Cartier during the 23d to the 30th. The Egyptian EIHAB I encountered heavy weather with damage on the 26th and 27th on the Mediterranean Sea. The ferry EUROPAFARJAN with 130 passengers ran aground off Grena, Denmark, in stormy weather on the 27th. No one was injured. The 1,027-ton REPULSE BAY reported an earlier encounter with heavy weather. The 4,596-ton LPG carrier MONOMER VENTURE dragged anchor at Coatzacoalcos on the 29th in strong northerly winds. The Russian OLENEK in tow of salvage tug HERMES called at Bremerhaven on the 31st due to heavy weather. The Greek-registered UHENFELS had weather damage on a voyage from Rotterdam to Buenos Aires.

The 11,421-ton American POET departed Philadelphia on the 24th. She gave a position report on the 25th after leaving Cape Henlopen and was not heard from again. A developing LOW was over Cape Henlopen at 1200 on the 25th and may have been a factor in the ship's disappearance.

Smooth Log, North Pacific Weather

September and October 1980

SMOOTH LOG, SEPTEMBER 1980--The storm traffic south of Alaska to latitude 40°N and east of longitude 180° was very heavy this month. The western ocean traffic was light except for tropical storms. Another area of dense storm traffic was from Manchuria across the southeast corner of the U.S.S.R. Two of these storms penetrated as far east as 180°. Only two storms came out of the primary climatic area of cyclogenesis off Japan. The storms south of Alaska had no preferred orientation. Climatology shows the primary storm track stretching from Honshu to the Gulf of Alaska, with a second primary track paralleling the first one about 600 mi to the south from 180° eastward.

In general the sea-level pressure over the North Pacific was near normal to slightly higher with the latter more prevalent. There were two 1008-mb centers of the Aleutian Low versus a climatic normal of 1006 mb. One center was near the climatic location over Bristol

Bay. The other was north of Umnak Island. The Pacific High was 1023 mb near 37°N, 145°W, about 300 mi north of its normal 1021-mb location. There were two 1018-mb bulges in the western extension of the Pacific High. There was also a 1009-mb LOW over the northern tip of Sakhalin Island (fig. 37).

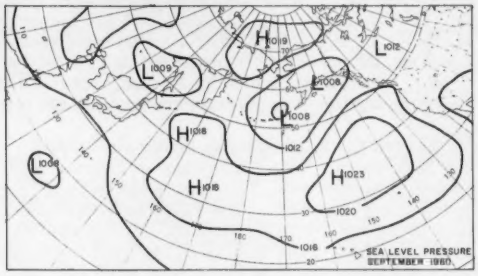


Figure 37.--Mean sea-level pressure.

The largest anomaly was plus 6 mb west of the Bering Strait. There was also a plus 4-mb area southeast of Mys Lopatka and a plus 3-mb area west of Vancouver Island. The largest negative anomaly was minus 2 mb near 46°N, 170°W.

There were three long-wave troughs at 700 mb that influenced the North Pacific weather. One was inland of the Asiatic coast. The next was eastward over the central ocean out of a low-pressure center over the Pribilof Islands, and the third was off the California coast. The usual ridge over the Canadian Rocky Mountains was less accentuated than normal.

There were six tropical cyclones over the western ocean and two over the eastern ocean. They were typhoons Orchid, Percy, Sperry, Vernon, and tropical storms Ruth and Thelma in the western ocean, while the eastern ocean hosted tropical storm Lester and hurricane Kay.

Extratropical Cyclones--The first 10 days of the month were relatively quiet. Early in the first week the Pacific High was near 35°N, 150°W, with multiple pressure centers over the northern ocean. The Pacific High gradually moved westward to the central ocean by the end of the week. By the end of the second week the Pacific High was back off the North American coast centered off Portland, Oreg. During the middle of the month the ocean was again separated into multiple centers, including several tropical LOWs. During the third week the Pacific High had a second center over midocean. In the last week of the month a large cyclone developed over the Gulf of Alaska with a weak High over the central ocean.

The first significant storm did not develop until the 11th. It was the result of the consolidation of three weak LOWs. The first gale report was by the PRESIDENT TRUMAN (39°N, 180°) at 0000. By 1200 the single 990-mb center was at 50°N, 173°W. The ALASKA MARU was northeast of the rapidly deepening center at 1800 with a pressure of 987 mb and easterly winds of 45 kn. At 0000 on the 12th the NOAA ship DISCOVERER was near 54°N, 164°W, about 650 mi east-northeast of the 976-mb center with 40-kn winds from the east and 18-ft seas. A ship far to the south near 36°N, reported 30-ft swell waves. At 0600 the USCGC MUNROE was near Saint George Island with 53-kn winds from the east and 21-ft seas. By 1200 the storm had dropped to a central pressure of 966 mb as it crossed the Aleutians near Sequam Island. On the 13th the MIYAJIMA MARU at 57°N, 177°E, was contending with 44-kn winds from the north and 20-ft waves. A ship near 53°N, 175°E, reported 33-ft swell waves. The ALL ALASKA was near the Shumagin Islands with 50-kn southerly winds as reported to WBH-29 at Kodiak. On the 14th the CAPTAIN HOOK reported 45- to 50-kn winds from the south in Halibut Bay. The LOW was now filling and wandering over the Bering Sea.

On the 15th and 16th the Pacific High was near 50°N, 145°W, at 1037 mb. There was weak low pressure near 34°N, 135°W. The pressure gradient was tighter closer to the high-pressure center than the low-pressure center. Several ships including the GOLDEN GATE BRIDGE, PRESIDENT MADISON, and PRINCE RUPERT CITY in the area of 40° to 45°N and 135° to 145°W reported gales up to 46 kn and swell waves up to 23 ft. On the west side of the HIGH the KARINITA (41°N, 162°W) measured 40-kn winds and 33-ft waves.

This LOW moved northward as a wave along a front west of the Pacific High. At 0000 on the 18th it was near Yakutat, Alaska, when it started deepening. At 1800 the PORTLAND was west of Port Alice with 40-kn winds. On the 19th several ships had winds up to 40 kn, including the GREAT LAND off Queen Charlotte Sound. The USCGC RUSH and the SOHIO INTREPID in the same area both estimated winds of 45 kn with 20- and 25-ft swell waves, respectively. The sea-wave analysis for the 19th and 20th showed an area centered near 50°N, 140°W, with 15-ft waves. At 0000 on the 20th the TONE MARU (50°N, 132°W) had 38-kn winds, 20-ft seas, and 28-ft swells. Later in the day the LOW was destroyed by the mountains.

This storm system was a combination of many LOWs. What appeared to be the originating LOW formed as a wave on a north-south front west of the Pacific High. The wave moved northward and the HIGH weakened. At 1800 on the 25th the PRESIDENT VAN BUREN (47°N, 169°W) southwest of the center had 48-kn winds. At 0000 on the 26th the storm was near 54°N, 161°W. That day there were several 40-kn wind reports.

At 0000 on the 27th the LOW was 960 mb northwest of Port Moller. Another strong LOW was racing eastward along 50°N, from the Sea of Okhotsk, into the circulation. There were two other small centers in the circulation, one to the south and another off the Oregon coast. There were many gale reports in this large circulation that stretched from British Columbia to Kamchatka and 70°N to 35°N. The ALASKA STANDARD at 59°N, 149°W, had 55-kn winds with 20-ft seas and 26-ft swells. A ship near the center of the Bering Sea had 30-ft waves. On the 28th the original LOW had curved westward, then southward, as the other LOWs traveled generally eastward. The PACMERCHANT (47°N, 145°W) measured 63-kn winds driving 20-ft seas with 33-ft swells. At 0600 OWS Papa had 51-kn winds from the southwest, and at 1200 the ARCO JUNEAU (50°N, 135°W) had the same speed from the

southeast. She didn't report waves, but a ship nearby had 25-ft waves and another near 42°N, 149°W, had 30-ft waves. The PRINCE WILLIAM SOUND (54°N, 140°W) measured 65-kn winds with 17-ft seas and 26-ft swells.

On the 29th the LOW that had been to the south pushed northward along 145°W and became the primary LOW. At 0000 the ARCO CALIFORNIA (58°N, 144°W) found 60-kn easterly winds with 36-ft waves. The pressure was 971 mb. The SANKO STEEL (54°N, 143°W) had 33-ft waves. The EXXON SAN FRANCISCO (55°N, 139°W) had 45-kn winds with 20-ft seas. The WRANGELL MARU (55°N, 145°W), with a pressure of 948 mb, 38-kn winds from the south, and 26-ft swells, was within a few miles of the center of the LOW. There were many gale reports. By 1200 this LOW south of Valdez was the only one remaining in the circulation. It was still a large storm, but it was shrinking.

The ARCO CALIFORNIA was steaming southeastward very slowly. By 0000 on the 30th she still had 25-ft waves near 57°N, 142°W, but her winds had dropped to 40 kn out of the south. At 1200 the PERENNIAL ACE (52°N, 170°W) was far from the center of the storm (almost 800 mi) with mild 35-kn winds from 350°, but had 46-ft swells from 030°. The storm was rapidly deteriorating and by midday on October 1 was nearly gone, as another LOW raced into the Gulf of Alaska from the south. A severe extratropical Thelma was moving northeastward.

Tropical storm Thelma became extratropical on the last day of the month. The storm made the transition as it passed east and in front of the POLLENGER. The only difference to the ship was a shift in direction and an increase in windspeed. The waves ranged from 23 to 30 ft. At 1200 on the 30th her winds were about 20 kn, waves 23 ft, and pressure 982 mb, while about 200 mi northeast of the tropical storm. At 1800 they were 52 kn, 26 ft, and 976 mb about 100 mi from the center, and at 0000 on October 1, the winds were 45 kn, seas 30 ft, and pressure 998 mb, while about 200 mi south of the storm. At 0600 the winds were still 45 kn with 28-ft seas. The MOSEL EXPRESS was on a collision course with the storm at 0000 on the 1st with 60-kn winds. No one ventured out to look at the waves. The PACBARON was near 50°N, 165°E, at 0600 and also on a collision course into the storm with 65-kn easterly winds, 26-ft seas, and 49-ft southeasterly swells. At 1200 the BUNKO MARU (46°N, 167°E) was about 250 mi south of the storm with 52-kn winds and 30-ft waves.

On the 0000 chart of October 2 the LOW was 960 mb. A ship east of the center had 33-ft waves. The BUNKO MARU now had 60-kn winds, and another Japanese ship found 64 kn south of the center. The EASTERN DIAMOND logged a 0300 report of measured 55-kn winds and 65-ft waves near 50°N, 172°E.

The storm center passed almost directly over the SEA-LAND TRADE sailing westward at about 0430 (fig. 38). She registered 960 mb on her barograph. Between 1200 and 1800 on the 1st the barograph fell 14.8 mb. Just prior to passing through the storm, her winds were 50 kn with 23-ft waves from the southwest. On the west side of the storm the winds decreased to 25 kn, but the swell waves were 25 to 30 ft. At 0600 on the 2d the EASTERN HIGHWAY (49°N, 174°E) encountered 60-kn winds and 33-ft waves, while the JLHP (49°N, 172°E) found 46-kn winds and 43-ft waves. The high swell waves at both ships continued through 1200. The storm was moving eastward along latitude 50°N and spreading

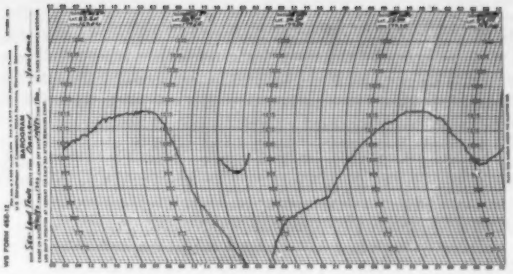


Figure 38.--The storm was so deep the barograph had to be reset to measure 960-mb pressure.

its influence, while weakening the gradient.

On the 3d the SILVERFJORD (46°N, 174°W) called the winds 48 kn with 26-ft swells. At 1200 on the 3d the closest ship to the storm to radio a weather report that was plotted on the chart was the OHMINESAN MARU in the middle of the Bering Sea about 700 mi northwest of the center. Another ship that helped with the analysis was the PRESIDENT ADAMS at 32°N, about 1,100 mi to the south. At 0000 on the 4th there were the usual number of reports. The winds were now generally gales with some waves over 20 ft, but most were 10 to 15 ft. A ship in the easterly flow northeast of the center found 23-ft waves. On the 5th the LOW split into a double center.

Tropical Cyclones, Eastern Pacific--Hurricane Kay started life on the 15th as a tropical depression about 300 mi south of Acapulco. By the 17th Kay was a hurricane on a west-northwesterly track. Kay reached her peak on the 19th when 115-kn winds were estimated near her center. The following day as Kay crossed the 120th meridian near 17°N, winds fell to 80 kn. By the 21st she was down to tropical-storm strength--down but not out. She recovered as she moved into central Pacific waters and was able to remain below 20°N. On the 22d she hovered near hurricane intensity, and by the 23d she found it--hurricane strength. Kay maintained hurricane force as she edged toward 20°N. On the 24th she was generating 80-kn winds just before crossing the 20th parallel near 139°W, then she began to weaken. On the 25th it was 75 kn, then 70 kn. The following day Kay, who had been travelling northwestward since the 24th, slowed and headed on a more westerly track. She clung tenaciously to that hurricane status until the 27th, near 23°N, 144°W. By the 29th Kay finally dropped to depression strength. She came within 200 mi of Honolulu, but was just a shadow of her former self. By the 30th she was heading northward and turning extratropical.

Tropical storm Lester was as brief as Kay was lengthy. He was first spotted about 120 mi south of Manzanillo on the 22d. Lester reached minimal tropical-storm strength the following day and retained it through the 24th. During the period he had wandered westward to about 110°W and stalled. By early on the 25th the stationary system was generating 25-kn maximum winds. Later that day the system dissipated.

Tropical Cyclones, Western Pacific--Typhoon Orchid developed in the waters north of Guam. On the 7th she

was a tropical storm heading west-northwestward. By the following day, after crossing the 20th parallel near 136°E, she began the familiar parabolic swing northward. Orchid blossomed to typhoon strength on the 9th. In an area of heavy shipping she was causing problems. The OCEAN CONTAINER, under tow by the tug SALVADORE, broke her towline in the rough seas of Orchid just east of Shikoku, off Cape Shio. The BEAURIVAGE, laden with more than 240,000 tons of crude oil, touched bottom while standing off the coast of Japan during Orchid. She sustained minor damage.

The most tragic account was that of the DERBYSHIRE, which last reported on the 9th that she was holding due to heavy seas and the approach of typhoon Orchid. Later the typhoon passed right over this last-reported position. All but one of the DERBYSHIRE's 42 crewmembers were British; two officers' wives were also on board. The ship was enroute for Kawasaki with a cargo of 158,000 tons of iron ore concentrates from Seven Island, Canada. This is one of the biggest losses under the British flag.

By the 10th maximum winds in Orchid had climbed to 80 kn as she made her way up the Ryukyus towards Kyushu. Even in port ships were having their problems. The SEA HAWK and HE TIAN collided while anchored at Mutsure, sinking the SEA HAWK. The master died, but all other crewmembers were rescued. The collision was caused by the HE TIAN apparently swinging in Orchid's gusty winds. The RYOJIN off Toba, the entrance to Ise Bay, dragged her anchor in rough seas and rammed the HYUNDAI, causing minor damage to both ships. Among the many ship reports the following had waves of 25 to 33 ft: CARDIGAN BAY, MITSUTAMA MARU, SEA-LAND TRADE, and TAKAYAMA MARU. The AMSTELMOLEN had 39-ft swells, the BARBER PERSEAS had 52-kn winds and 52-ft swells, and the NEDLLOYD STEENKERK battled 60-kn winds and 59-ft swells.

Orchid moved across Kyushu on the 11th and dropped to tropical-storm strength as she moved through the Sea of Japan. The storm resulted in six deaths. Torrential rains fell over Kyushu, Shikoku, and western Honshu; 15 to 23 in were recorded in several locations. Heavy rains also triggered landslides in Korea, resulting in another six deaths. About 110 fishermen were unaccounted for after high seas disabled 11 vessels. Orchid weakened and began to turn extratropical in the Sea of Japan.

Within the next few days there was an outbreak of depressions along the 18th parallel stretching from 150°E westward to 115°E. These systems were soon to develop into typhoon Ruth off Hainan, typhoon Percy in the northern Philippine Sea, and typhoon Sperry northeast of Saipan.

Ruth was the shortest lived of the three. Early on the 15th tropical storm Ruth crossed the Hainan coast about 40 mi southeast of Haikou, where a maximum gust of 62 kn and a minimum pressure of 992 mb were recorded. Ruth intensified as she moved across the Gulf of Tonkin. It is probable that she attained typhoon strength early on the 16th; a surface wind of 70 kn, at 2 a.m. LST, was reported at Bach Longvi, an island station about 45 mi from the center. Later, Ruth reached the Vietnam coast about 95 mi south of Hanoi. Winds were estimated at 75 kn around her 970-mb pressure center. According to the press, Ruth was the worst typhoon to hit Thanh Hoa province in 30 yr. At least 106 people died or are missing, while 500,000 were left homeless. A major rice-growing region was devastated, with the loss of about 2 million tons. Ruth dissipated over Lao late on the 16th.

Meanwhile, Percy had gained typhoon strength, on a slow northwestward course, about 400 mi northeast of Manila. Early on the 17th reconnaissance aircraft reported surface winds of 80 kn. Late in the evening Lan Yu Island off southeast Taiwan, some 90 mi from the center, reported a sustained wind of 99 kn from the north with gusts to 118 kn; this station is at an elevation of 1,065 ft. Percy peaked early on the 18th when surface winds were estimated at 125 kn. The AMERICAN AQUARIUS was in the northeast quadrant of the storm on the 18th and 19th with 45-kn winds and waves up to 20 ft.

A few days earlier the GOLDEN PEAK had sent an S.O.S. that its main generator was out of order and the engineroom was flooded. The ship was in the Taiwan Strait close to Taiwan. The steering gear had failed initially. After drifting and then anchoring, the vessel started to drag towards Taichung. Both anchors gave way as Percy approached, and early on the 18th the GOLDEN EAGLE grounded hard near Taichung's rock causeway.

Percy crossed the southern tip of Taiwan early on the 18th, close to Hengchun, and caused serious damage. Nine people died, 400 homes collapsed or were destroyed, while banana and sugar cane plantations were devastated. During the afternoon the NEDLLOYD NAPIER, some 80 mi northwest of Percy's center, encountered 55-kn winds and a 994-mb pressure. Percy weakened and slowed as he headed for mainland China. Early on the 19th he crossed the coast about 50 mi northeast of Shantou. Once inland he dissipated rapidly.

Typhoon Sperry was already brewing far to the east as Percy crossed the China coast. Sperry was spotted on the 15th between Saipan and Marcus Island. Heading west-northwestward, Sperry intensified to tropical-storm strength that same day and started to recurve the following day. It wasn't until the 18th that he reached typhoon strength, at the same time Percy was ravaging Taiwan. The TAKAYAMA MARU found 33-ft swells. By now the typhoon was turning eastward. Late on the 19th after crossing the 145th meridian near 31°N, Sperry was downgraded to tropical-storm status. He soon became extratropical.

Tropical storm Thelma and typhoon Vernon came to life within 1 day of each other and about 900 mi apart. Thelma was detected on the 26th about 200 mi northwest of Saipan, while Vernon was found the same distance west-northwest of Eniwetok the following day. Both moved on a parabolic course, but Vernon was initially less decisive and trailed Thelma by several days. Thelma's northward movement past Iwo Jima on the 28th may have influenced the initial slow movement of Vernon. Thelma's winds reached a peak of about 55 kn on the 30th. The ARILD MAERSK found 50-kn winds and 30-ft seas about 180 mi north of the storm. The MITO MARU off Yokohama had 45-kn winds and 30-ft waves. By this time Thelma was across the 30th parallel and accelerating rapidly northeastward; she was also fast becoming extratropical. Vernon, meanwhile, had just become a typhoon and was still below 20°N. By the 1st Vernon's winds had climbed to more than 100 kn as he moved 200 mi west of Marcus Island. Vernon

continued to intensify, reaching a peak of 110 kn the following day. Gusts were estimated at 135 kn. with gales extending out 200 to 300 mi. Vernon was beginning to turn northeastward as he crossed 30°N near 149°E. The YAMAHIDE MARU (38°N, 153°E) had northeasterly 60-kn winds and 23-ft waves. He was also starting an extratropical transformation as cool air entered his circulation. However, Vernon's winds were still estimated at 50 kn with gusts to 65 kn when the last tropical warning was issued on the 3d.

Casualties--The Philippine wine tanker DONA SUSANA was aground in adverse seas and weather conditions at Kalatogan on the 13th. The 64,631-ton Liberian tanker was at Yokohama on the 16th with weather damage. The 6,334-ton BUM IL developed engine trouble from Busan to Los Angeles on the 27th. Heavy weather on the 29th resulted in an S.O.S. and the crew of 28 were rescued by the Japanese patrol vessel MIURA on October 2.

Other Casualties--The Greek EPIMENDIS was damaged by barges in heavy swell at a Peruvian port.

SMOOTH LOG, OCTOBER 1980--The storm systems this month were reversed from what might be expected. The first half of the month there were a few large storms, while the last half of the month there were many smaller systems. One would expect the opposite trend with the winter season approaching. The primary storm track came out of the Sea of Japan across the La Perouse Strait and continued eastward south of the Aleutians into the Gulf of Alaska, where it turned sharply northward. A few storms formed in the climatic area of principal cyclogenesis east of Japan, traveled northeastward, and joined the primary track near 180°. Additional cyclones that came into being southwest of the Gulf of Alaska contributed to the congested storm traffic over the Gulf.

The mean sea-level pressure closely matched the climatic mean. The 998-mb Aleutian Low near 54°N, 158°W, was about 200 mi south of its 1001-mb climatic counterpart. The Pacific High had a long, narrow east-west configuration along latitude 32°N with two 1022-mb centers at each end near 33°N, 136°W, and 32°N, 179°W. These were 3 mb higher than climatology. North of latitude 40°N the pressure departures were generally negative with a minus 7-mb anomaly center near 50°N, 160°W. South of 40°N the sea-level pressure was generally higher than normal. An exception was a plus 5-mb anomaly center over the mountains of British Columbia (fig. 39).

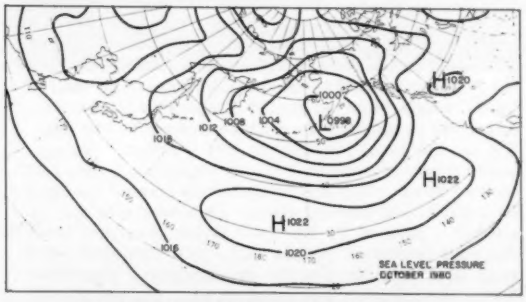


Figure 39.--Mean sea-level pressure.

The upper air flow was primarily zonal over the midlatitudes from the Asian coast to 160°W. There were long-wave troughs slightly interior of the Asian coast and approximating 155°W longitude. The ridge over western North America was steeper than normal. As at the surface, the pressure heights were lower than normal north of latitude 40°N, except in western Canada, and higher south of that latitude.

There were four tropical cyclones over the western ocean: typhoons Wynne and Betty and tropical storms Alex and Cary. Over the eastern ocean there were two tropical storms, Madeline and Newton.

Extratropical Cyclones--The first week of the month the Pacific High was over the central ocean with low-pressure systems moving across the northern waters. During the first 2 weeks there were low-pressure centers off the North American coast. The Pacific High drifted eastward during the third week and weekend to reappear over the central ocean the fourth week. During the last 2 weeks of the month the ocean was dominated by many small pressure cells. The first few days of the month the ocean was affected by a September storm.

The first significant extratropical storm was the transformation of typhoon Vernon. By 1200 on the 4th Vernon had completely incorporated a frontal system into the circulation. The AKAISHI MARU was west of the storm with 44-kn winds and 23-ft waves at 1800. At 2100 the FORSYTHIA radioed a wind report of 66 kn, while about 200 mi north of the storm. On the 0000 analysis of the 5th, the 964-mb storm was near 48°N, 174°E. Two ships, including the SILVERFJORD, had winds of 60 kn or over and swell waves to 33 ft. The SILVERFJORD near 46°N, 175°E, had a pressure of 969 mb. Others were reporting winds near 50 kn and waves of 20 to 30 ft. At 0300 her wind report read 80 kn and the barometer at 963.7 mb indicated she was very near the center of the storm. The wind waves were 20 ft, but the swell wave read code 50, which was probably an error in the communications. If not, a description from the ship would be appreciated.

By 0000 on the 6th the storm was 966 mb near 51°N, 168°W. The SUNNY PIONEER (48°N, 177°W) found 46-kn winds with seas and swells of 59 ft. Other ships in the area were reporting waves up to 35 ft. On the 7th the SEA-LAND DEVELOPER (43°N, 149°W) had 45-kn winds with 20-ft waves. About 2000 on the 6th the OVERSEAS NEW YORK passed very close to the storm (fig. 40). Her barograph indicated 971 mb, and the analy-

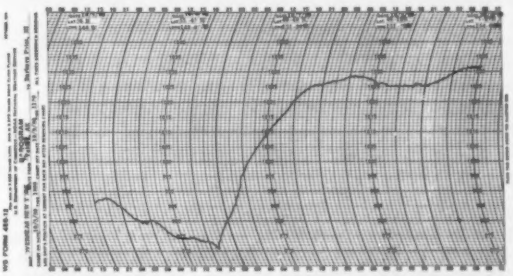


Figure 40.--The barogram of the OVERSEAS NEW YORK rose rapidly after dropping to 971 mb.

sis indicated a central pressure of 972 mb. As she moved south of the storm on the 7th, her winds increased to 45 kn and the waves to 20 ft. The buoy 46003 measured 40-kn winds, and a ship on the southwestern edge of the storm had 23-ft waves. At this time a second center formed north of this one. By 1200 the original center could not be identified. The SHUNWIND found 36-ft swell waves near 54°N, 145°W, on the 8th. The new LOW died over Alaska by the 9th.

This storm came out of Manchuria and was north of the La Perouse Strait late on the 7th. It moved northeastward and was 974 mb on the 9th over the Kamchatka Peninsula. A station on the west coast measured 40 kn. St. Paul Island measured winds of 37 kn with gusts to 44 kn. The GREEN AUKLET at 52°N, 165°E, had 45-kn winds and 20-ft waves at 0000 on the 10th. At 0600 the OHMINESAN MARU on the Bering Sea at 60°N, 178°W, had 48-kn winds from the southeast, and the OCTA (52°N, 170°E) measured 44 kn with 28-ft seas. Far to the south the HAKUZAN MARU (47°N, 165°E) encountered 20-ft swell waves in light winds. On the 11th the storm was north of 60°N and weakening. The AMERICAN RELIANCE at 54°N, 162°E, had only 25-kn winds, but swell waves were towering at 33 ft. There were still a few gale reports. On the 13th the storm broke into multiple centers, which reunited on the 14th and moved over the Seward Peninsula.

As typhoon Wynne traveled along the south coast of Honshu, an extratropical LOW formed east of Hokkaido on the 14th. There was a small anomalous LOW in the warm sector, and the KHOUDOJNIK GUERASSIMOV was in its southern edge with 60-kn winds and 20-ft seas. The SHINZUI MARU (46°N, 155°E) was behind the cold front with 50-kn winds. The FALSTRIA measured 46 kn driving 30-ft seas.

By 1200 on the 15th the LOW had dropped to 964 mb near 51°N, 174°E. The SEA-LAND MCLEAN was 550 mi east of the storm with southeasterly 48-kn winds. The CLOVER was due south of the center at 38°N with 30-ft seas and 39-ft swells as she passed through a trough line. The towline from the tug SMIT NEW YORK to the drilling platform DAN PRINCE snapped the night of the 15th about 400 mi south of Dutch Harbour. The helicopter pad was destroyed in 40-ft waves and force 12 winds. The tow was reconnected on the 19th; but the drill stem broke loose and the crew evacuated on the 21st. They were taken aboard the CGC BOUTWELL. The rig capsized on the 22d and sank. Cold Bay, Alaska, measured winds of 36 kn. Several ships measured winds over 50 kn on the 15th, including the SHUNWIND which measured 60-kn winds and 26-ft waves. On the 16th there were four ships in the southwest quadrant near the cold front with gales. The central pressure was now 960 mb. At 1200 the NOAA ship DISCOVERER (54°N, 165°W) measured 44-kn easterly winds. Her pressure was 969.5 mb. A ship near 44°N, 179°W, had 26-ft waves, and the EASTERN WORLD had 33-ft swell waves with only 35-kn winds. On the 17th the storm was turning northward. There were several ships in the southern half of the storm with gales. Three ships in the vicinity of 49°N, 156°W, had winds between 40 and 55 kn with waves of 30 to 36 ft. At 0000 on the 18th the SOUTH EXPRESS at 49°N, 156°W, had 55-kn northeasterly winds and 43-ft waves. Later in the day OWS Papa had 42 kn and 20-ft seas. On the 19th the ASIA INDUSTRY (47°N, 166°W) had 26-ft swell waves. In the southerly flow a ship had 23-ft swells. The LOW was west of the Alaska Range on the 20th and the ALASKA STANDARD was sailing out of Valdez near Montague Island and found 60-kn east-southeasterly winds with 33-ft waves. Six hours later the winds had dropped to 50 kn, but the waves were still 33 ft. On the 21st the LOW disappeared near Point Barrow as another strong storm entered the Gulf.

This was another storm that came out of Manchuria. After the LOW crossed Kamchatka on the 18th, it deepened and expanded. A ship near 51°N, 163°E, found 51-kn northwesterly winds with 36-ft swells on the 19th. A Soviet ship south of Ostrov Beringa reported 55-kn winds. The storm was still strengthening on the 20th as the TOYOTA MARU No. 10 encountered 33-ft swell waves near 45°N and the Date Line. The CGC BOUTWELL caught 40-kn winds and 25-ft seas just east of the front about 500 mi south of Unimak Island. Papa measured 57-kn winds at 1500. On the 21st the SEA-LAND LIBERATOR (45°N, 153°W), also slightly east of the front, had southeasterly 48-kn winds and 33-ft waves.

On the 22d the storm was 976 mb south of Kodiak. The FEDSTEEL was west of the Queen Charlotte Islands with 60-kn winds. The NEWARK measured 65-kn winds with 33-ft swell waves east of the LOW, and the USCGC MELLON had 36-ft swell waves north of the center. Waves of 20 to 25 ft were still being generated in the southwestern quadrant of the storm. New low centers had now formed both north and south of the original center, and by the 23d it disappeared. The stronger winds and high waves were now in the southerly flow. Late in the day the SOHIO INTREPID (53°N, 140°W) had 45-kn winds with 20-ft seas and 25-ft swells. The northern center was tracking northwestward over the Bering Sea, and the southern center tracked northeastward toward Yakutat. On the 24th the NEWARK and another SHIP were within a few miles of each other near 54°N, 138°W, with 65- and 50-kn winds and 23- and 33-ft waves, respectively. The LOW turned northwestward then northward through Cook Inlet. As the front moved inland, it took the high winds with it. The LOW continued into the Beaufort Sea.

Tropical Cyclones, Western Pacific--Supertyphoon Wynne was spotted south of Truk on the 4th. The tropical storm was heading toward the northwest. This brought her close to Guam just after 1200 on the 6th. Wynne remained a tropical storm until the 8th after turning west-northwestward. She then literally exploded as winds increased from 70 kn at 1200 on the 8th to 150 kn some 24 hr later, when the supertyphoon crossed the 135th meridian near 19°N. Gusts were estimated at 180 kn. Minimum sea-level pressure was estimated at about 890 mb. Tip set the record of 870 mb just 1 yr ago. Wynne began to recurve on the 11th as maximum winds fell below 130 kn. The following day she blasted the Ryukyu Islands with 100-kn winds. Okinoerabu Island recorded a gust of 91 kn. As Wynne recurved toward the east-northeast on the 13th, she swamped hundreds of houses on Kyushu and triggered numerous landslides with her torrential rains. The accelerating storm brushed Honshu on its southern coast before

moving out to sea on the 14th. Winds were still at typhoon force, but the storm was weakening and turning extratropical. In her wake Wynne left three people dead and 26 injured. About 12 boats were lost or damaged. The Panamanian SEMPOR and Korean TEST HWA HO were both blown aground; all crewmembers were rescued.

While Wynne was moving through the Ryukyus, Alex popped up southeast of Iwo Jima. He was a tropical depression on the 12th. The following day Alex was christened just west of Chichi Jima. At this time Alex was moving northwestward toward Japan, which was now being threatened by two storms. However, Alex recurved toward the northeast later on the 13th. He never climbed above minimal tropical storm strength; by the 14th he was weakening rapidly. The SAMOA passed very close to the center of what remained of the storm at 0500 on the 14th. Her pressure dropped to 991 mb and the winds increased to 44 kn with 16-ft waves.

Just before the month came to a close typhoon Betty developed on the 29th near Truk, while tropical storm Cary came to life over southern Luzon. Both headed west-northwestward. Cary reached tropical-storm strength over the South China Sea on the 30th--the same day Betty climbed to typhoon strength just south of Guam. On Guam three people were injured and 30 homes were destroyed. Betty altered her course to the west, while Cary made a sharper turn and headed west-southwestward for Vietnam. On the 1st he raked the Paracel Islands with gales and Sanhu Dao, 150 mi north of Cary's center, reported sustained winds of 40 kn with gusts to 62 kn. Meanwhile, Betty was generating 90-kn winds and heading for Luzon moving close to the 15th parallel. As Cary was dissipating 120 mi northeast of Ho Chi Minh Ville on the 2d, Betty continued to wind up as she crossed the 130th meridian near 15°N. As Betty approached Luzon she continued to intensify; she reached a peak of 120 kn on the 4th shortly before barging ashore over Luzon's Sierra Madre Mountains. She was the strongest typhoon to hit the Philippines this year, and a state of emergency was declared in 113 towns throughout eight northern and central Luzon provinces. At least 68 people died

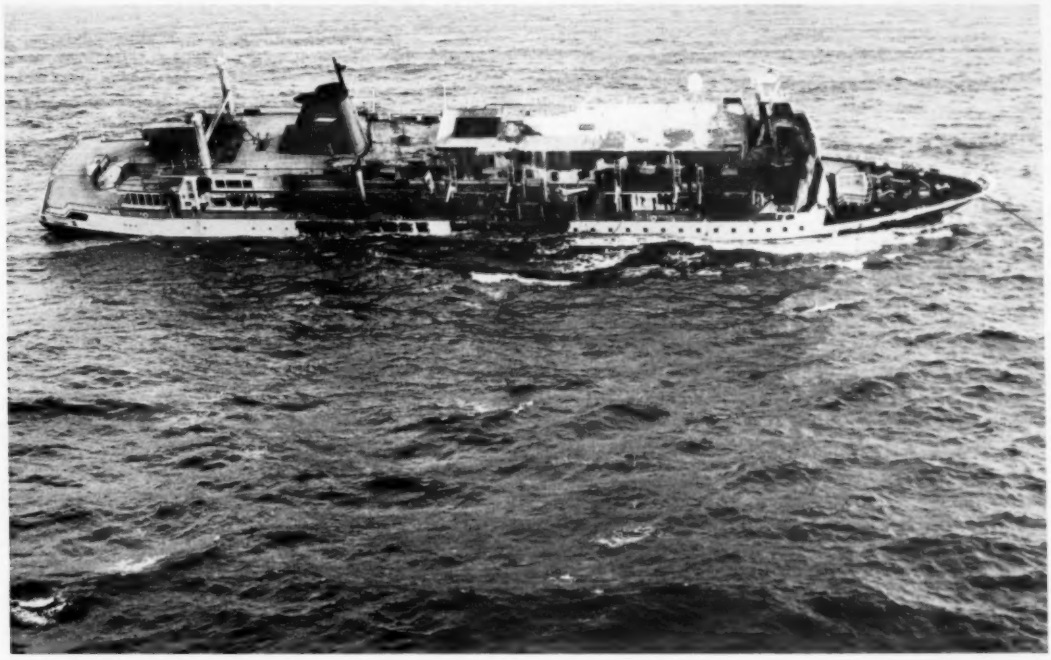


Figure 41.--The PRINSENDAM has a heavy list and was still smoldering as an attempt was made to tow her to a safe haven. U.S. Coast Guard Photo.

and 229,000 were left homeless; 50 people were missing. Two ships under tow, the GENERAL SAN MARTIN and ANCAP CUARTO, took on water during the typhoon and suffered extensive damage. The ANCAP CUARTO was driven aground east of Baguio.

The rugged terrain of Luzon took its toll. Betty recurved along the west coast as a tropical storm. By the 6th she was through the Balintang and Bashi Channels and paralleling the Ryukyu Islands. The following day Betty continued to weaken and turned extratropical.

Tropical Cyclones, Eastern Pacific--Two tropical storms, Madeline and Newton, flared briefly in the eastern Pacific between Socorro and Clipperton Islands. Madeline was a 2-day wonder as maximum winds climbed to about 45 kn late on the 11th. The following day the northwestward-moving storm began to peter out near 16°N, 111°E. This was about where Newton was born more than 2 weeks later, on the 28th. Newton reached minimal tropical-storm strength as he meandered eastward. However, the following day he was a dissipating depression about 100 mi southwest of Mazatlan.

Casualties--The 8,566-ton cruise liner PRINSENDAM caught fire in the engineroom at 0130 local time (0930Z) on the 4th. The fire became uncontrollable, and 510 passengers and crew abandoned ship at daylight. Air Force and Coast Guard helicopters assisted in the rescue. The waves were 15 to 25 ft, the winds 30 to 50 kn, sea temperature 40°F, and air temperature 50°F. Most of the people were put aboard the WILLIAMSBURGH and CGC BOUTWELL. The BOUTWELL rescued 18 passengers and 2 Air Force pararescuemen from a lifeboat early on the morning of the 5th. There were no serious casualties. The PRINSENDAM (fig. 41) sank on the 11th while still smoldering. For additional details on the rescue, see page 24 of the January-February 1981 issue.

The 11,096-ton Greek SEMI was due Nagoya on the 7th with heavy-weather damage. The 20,747-ton British SILVERFJORD was due Kobe on the 13th with heavy-weather damage. That day the STAR MAGNATE requested a survey at Kobe for weather damage. The 9,026-ton Nigerian RIVER OJI reported heavy weather damage on the 14th. The 10,520-ton bulkcarrier GRAND GLOBE had weather damage on a voyage from Vancouver to Yokohama.

The 26,456-ton American PRESIDENT GRANT and the 80-ft fishing vessel MARTIN HIGGINS collided in fog outside the Golden Gate Bridge on the 22d. The 8,503-ton EUROTRADER from Singapore for North Korea claimed heavy weather from the 21st to the 30th with force 10 to 12 winds. Vessel beached in Pescadores Islands and plundered after abandonment by the crew. The bulkcarrier SOUTH GLORY was due Mizushima on the 31st with weather damage. The ALENDALE was repaired in Japan for heavy-weather damage.

Other Casualties--The 3,747-ton POLAR PARAGUAY dragged anchor in strong winds at Melbourne on the 3d. The NANCY HEATH encountered heavy weather enroute to Melbourne. The IRON SHORTLAND had weather damage from Newcastle to Port Hedland. The SNOW WHITE had heavy weather on the 13th and 14th during a voyage from Kyushu to Saudi Arabia.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

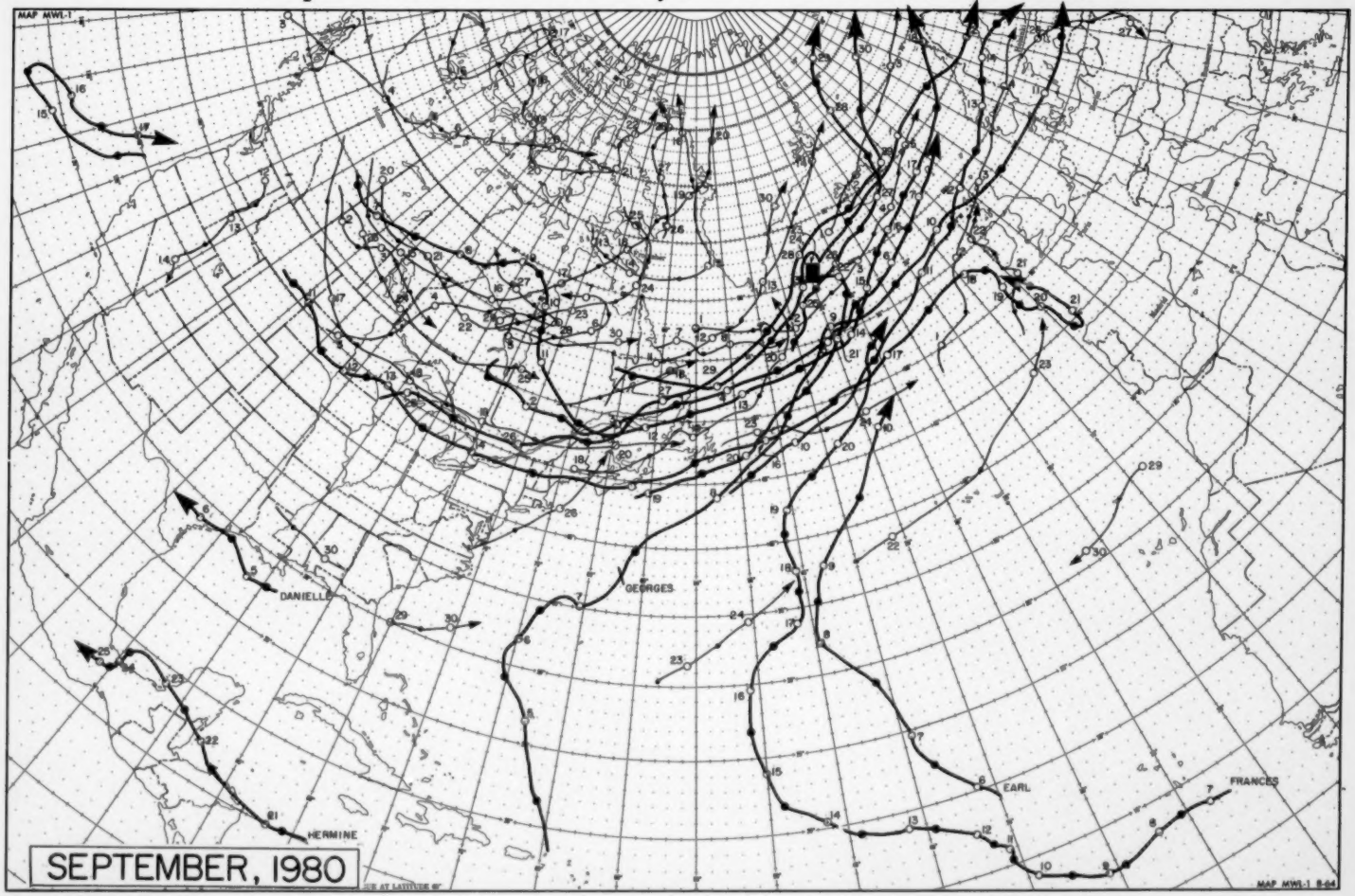


Figure 42. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

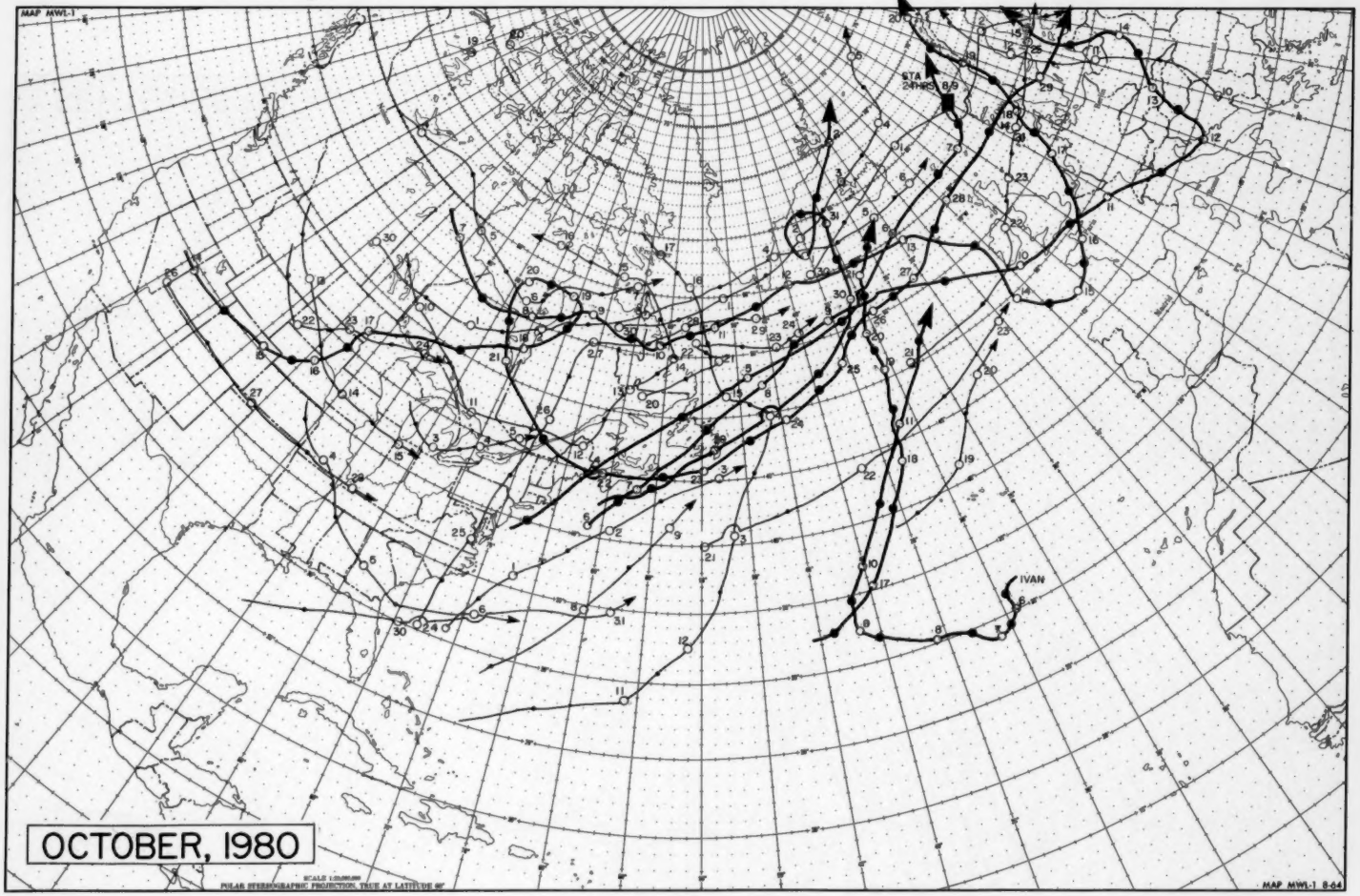


Figure 43. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

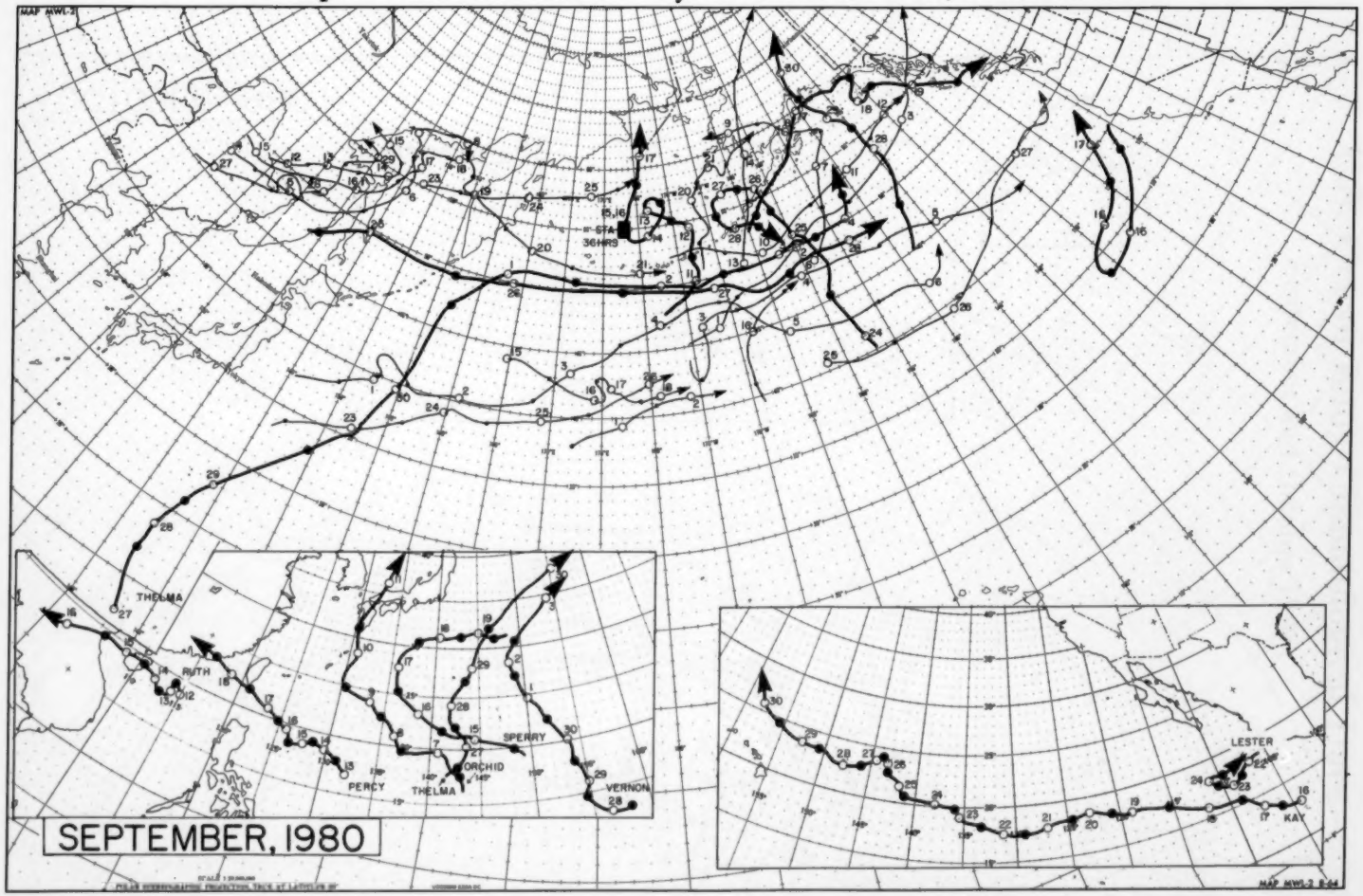


Figure 44. ---Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

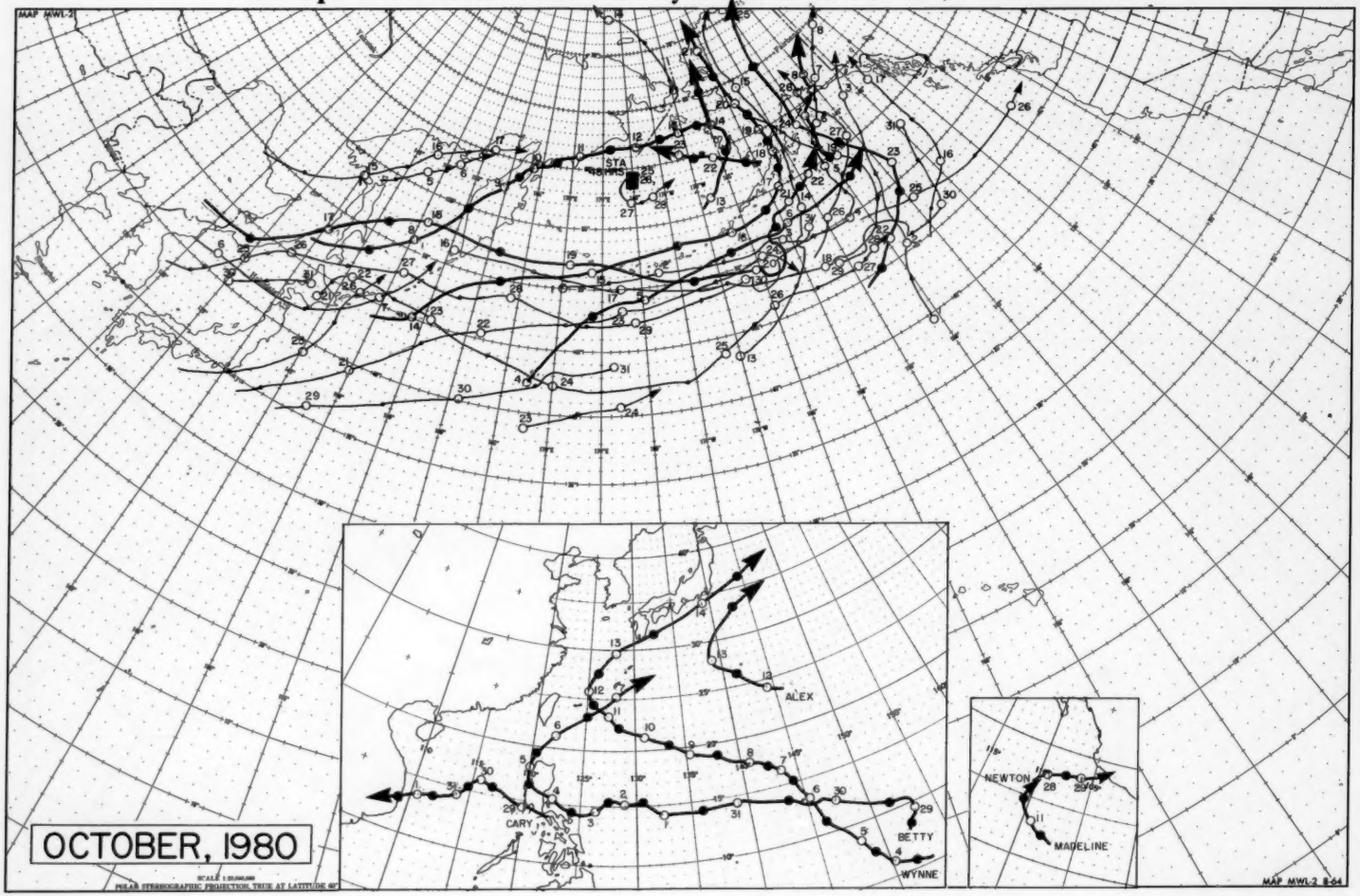


Figure 45. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

U.S. Ocean Buoy Climatological Data

September and October 1980

SEPTEMBER D A T A S U M M A R Y #1001
AVERAGE LATITUDE 34.7N AVERAGE LONGITUDE 072.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	20.2	(28 09)	25.1	27.3	(15 18)	207	30
SEA TEMP (DEG C)	24.8	(30 12)	25.9	27.9	(04 21)	211	30
AIR-SEA TEMP (DEG C)	-05.0	(26 09)	-00.8	01.2	(15 15)	207	30
PRESSURE (MBAR)	1007.2	(30 21)	1019.7	1024.9	(20 15)	207	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 207
N		4.8	8.7				13.5	12.1	MAX WIND
NE		4.8	8.7				13.5	11.2	SPEED: 28 KNOTS
E	1.4	11.6	2.9	1.9			17.9	9.8	DIRECTION: 060 DEG
SE	2.4	2.4		.5			5.3	6.0	DAY: 30
S	1.0	9.2	9.7				19.8	9.9	HOUR: 00
SW	1.0	1.9	14.0	1.0			17.9	13.5	
W		3.9	9.8				13.7	10.4	
NW	.5	1.0	1.4				2.9	11.5	
CALM									
TOTAL	5.3	40.1	50.2	3.4			100.0	10.9	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 204

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	34.6	59.8	5.4	1.0					1.0M	3.0M (30 12)

OCTOBER D A T A S U M M A R Y #1001
AVERAGE LATITUDE 34.7N AVERAGE LONGITUDE 072.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	19.8	(14 06)	21.6	24.6	(04 03)	220	31
SEA TEMP (DEG C)	22.1	(31 12)	24.1	26.0	(03 16)	220	31
AIR-SEA TEMP (DEG C)	-04.0	(14 06)	-02.5	01.1	(29 00)	220	31
PRESSURE (MBAR)	1002.2	(01 09)	1017.6	1029.1	(23 15)	222	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 217
N	1.4	5.5	8.8	.9			16.6	12.9	MAX WIND
NE	.5	1.8	4.6	2.8			9.7	15.6	SPEED: 32 KNOTS
E	1.4	.5	.9	2.3			5.1	16.8	DIRECTION: 130 DEG
SE	1.4	4.1	1.4				11.1	11.6	DAY: 25
S	.9	7.7	6.4	.9			17.0	12.1	HOUR: 09
SW	.5	5.1	10.1	1.7			19.4	15.7	
W		7.5	6.5	3.2			17.4	17.4	
NW		3.7	6.5	1.8			12.0	15.7	
CALM	1.8						1.8	.0	
TOTAL	7.4	27.2	48.4	17.1			100.0	14.3	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 220

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	21.6	36.6	32.7	4.1	5.0				1.6M	5.5M (26 06)

SEPTEMBER D A T A S U M M A R Y #1002
AVERAGE LATITUDE 32.3N AVERAGE LONGITUDE 075.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	21.1	(28 18)	26.3	29.1	(16 21)	240	30
SEA TEMP (DEG C)	26.8	(30 09)	27.5	29.6	(02 21)	240	30
AIR-SEA TEMP (DEG C)	-05.9	(26 18)	-01.2	00.6	(16 21)	240	30
PRESSURE (MBAR)	1003.6	(30 21)	1017.2	1025.0	(19 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 240
N	.4	2.5					2.9	8.0	MAX WIND
NE	1.7	9.2	11.3				22.1	11.0	SPEED: 29 KNOTS
E	.8	9.6	8.8	2.5			21.7	12.6	DIRECTION: 100 DEG
SE	1.2	5.4	1.7				10.4	7.9	DAY: 29
S	2.1	17.5	2.5				22.1	7.0	HOUR: 15
SW	.8	7.1	2.5				10.4	7.7	
W	.8	5.8	2.5				7.1	6.5	
NW	1.3	.4					1.7	4.0	
CALM	1.3						1.3	.0	
TOTAL	9.6	58.8	29.2	2.5			100.0	9.3	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	27.9	65.4	5.4	.8					1.0M	3.0M (30 00)

OCTOBER D A T A S U M M A R Y #1002
AVERAGE LATITUDE 32.3N AVERAGE LONGITUDE 075.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	16.6	(26 12)	23.3	26.9	(03 21)	248	31
SEA TEMP (DEG C)	24.5	(30 21)	25.8	27.2	(09 21)	248	31
AIR-SEA TEMP (DEG C)	-08.1	(26 12)	-02.6	00.3	(02 15)	248	31
PRESSURE (MBAR)	1004.1	(01 00)	1015.5	1024.9	(15 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 248
N	1.2	5.2	8.1	1.6			16.1	11.8	MAX WIND
NE	4.0	4.0	4.0	2.0	.4		14.5	11.9	SPEED: 36 KNOTS
E	2.4	7.7	6.9	1.6	.8		19.4	12.5	DIRECTION: 070 DEG
SE	1.2	1.6	1.6				4.5	8.6	DAY: 24
S	1.6	1.6	6.9				12.1	11.2	HOUR: 03
SW	.4	2.0	11.3	.8			14.5	14.9	
W	.4	1.6	2.0				4.5	17.1	
NW		.8	6.9				7.7	13.8	
CALM	.4						.4	.0	
TOTAL	13.1	24.2	50.4	6.1	1.2		100.0	12.7	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	14.9	51.2	23.4	9.0	1.5				1.6M	5.5M (24 18)

SEPTEMBER D A T A S U M M A R Y #1003
AVERAGE LATITUDE 30.3N AVERAGE LONGITUDE 080.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	20.7	(09 09)	27.3	28.5	(25 18)	240	30
SEA TEMP (DEG C)	27.2	(05 15)	28.3	29.6	(24 21)	240	30
AIR-SEA TEMP (DEG C)	-07.2	(09 09)	-00.9	00.7	(05 15)	240	30
PRESSURE (MBAR)	1006.2	(30 21)	1016.8	1022.5	(19 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 238
N		5.5	1.7				7.1	7.8	MAX WIND
NE	.4	5.0	4.2				12.6	9.0	SPEED: 23 KNOTS
E	2.1	14.7	11.8	.4			29.0	9.7	DIRECTION: 060 DEG
SE	1.7	9.0	4.2				13.9	8.1	DAY: 09
S	.4	7.1	7.6				15.1	10.7	HOUR: 09
SW	1.7	9.6	1.3				7.6	7.1	
W	1.3	3.3	.8				5.9	5.9	
NW	1.3	2.5	.8				4.6	6.6	
CALM	4.2						4.2	.0	
TOTAL	13.0	56.2	32.4	.4			100.0	8.4	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	32.9	65.0	2.1						.9M	2.5M (29 09)

OCTOBER D A T A S U M M A R Y #1003
AVERAGE LATITUDE 30.3N AVERAGE LONGITUDE 080.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	16.3	(26 12)	24.1	27.6	(01 00)	248	31
SEA TEMP (DEG C)	24.9	(31 21)	26.2	28.1	(01 00)	248	31
AIR-SEA TEMP (DEG C)	-10.3	(26 15)	-02.2	00.6	(17 15)	248	31
PRESSURE (MBAR)	1006.5	(01 09)	1016.0	1024.1	(26 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 248
N	.4	4.4	12.1	4.0			21.4	15.4	MAX WIND
NE	.4	7.3	5.2	.8			15.3	11.1	SPEED: 27 KNOTS
E	.8	7.3	10.9				19.1	12.3	DIRECTION: 360 DEG
SE	.4	7.3	5.2				11.9	10.3	DAY: 31
S	.4	2.4	4.0				6.9	12.3	HOUR: 12
SW		2.0	4.0				6.9	11.5	
W		3.3	8.1	.4			12.1	13.0	
NW	.4	4.7	5.2	.4			10.1	10.6	
CALM	.8						.8	.0	
TOTAL	4.0	34.7	55.6	5.6			100.0	12.3	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	20.2	63.1	15.7	2.0					1.2M	3.0M (25 00)

SEPTEMBER D A T A S U M M A R Y #1004
AVERAGE LATITUDE 32.6N AVERAGE LONGITUDE 079.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	22.9	(29 15)	26.9	29.0	(19 21)	239	30
SEA TEMP (DEG C)	26.7	(02 06)	28.0	30.3	(02 18)	239	30
AIR-SEA TEMP (DEG C)	-05.1	(29 15)	-01.1	00.5	(18 03)	239	30
PRESSURE (MBAR)	1006.5	(30 21)	1017.6	1023.5	(04 15)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 239
N	1.3	2.9	.4				4.6	5.6	MAX WIND
NE	.4	6.7	9.6				17.2	12.4	SPEED: 24 KNOTS
E	4.6	6.3	8.4	.4			20.5	8.9	DIRECTION: 070 DEG
SE	2.5	5.9	.8				9.2	5.9	DAY: 29
S	1.7	10.0	5.9				17.6	9.3	HOUR: 15
SW	1.7	5.0	10.9				17.6	10.6	
W	1.7	1.7	2.5				5.9	8.9	
NW	2.1	5.4					7.5	4.8	
CALM									
TOTAL	16.3	46.9	38.8	.4			100.0	9.1	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 237

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	30.8	60.3	7.2	1.7					1.0M	3.5M (29 21)

OCTOBER D A T A S U M M A R Y #1004
AVERAGE LATITUDE 32.6N AVERAGE LONGITUDE 076.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	17.3	(26 12)	22.0	26.2	(12 03)	247	31
SEA TEMP (DEG C)	27.6	(26 00)	25.6	27.9	(01 00)	247	31
AIR-SEA TEMP (DEG C)	-10.4	(26 12)	-03.5	00.3	(16 15)	247	31
PRESSURE (MBAR)	1007.4	(01 06)	1016.6	1024.6	(15 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 247
N	1.2	5.3	7.7	.8			15.0	12.6	MAX WIND
NE	2.0	6.1	7.3	4.0	.8		20.2	15.4	SPEED: 34 KNOTS
E	1.2	7.7	7.3	.8	.4		15.0	10.0	DIRECTION: 050 DEG
SE	.8	4.0	1.6				6.1	8.4	DAY: 24
S	.4	2.4	4.0				6.9	10.3	HOUR: 06
SW		4.0	9.7	.4			10.1	13.5	
W	.8	3.3	8.9	2.4			15.4	12.7	
NW	.8	7.3	2.8	.4			11.3	9.6	
CALM									
TOTAL	6.9	47.1	61.3	8.5	1.2		100.0	12.1	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6- 9	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	33.4	46.6	15.4	2.4	3.2				1.3M	5.0M (24 09)

SEPTEMBER DATA SUMMARY 42001

AVERAGE LATITUDE 25.9N AVERAGE LONGITUDE 089.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	22.9	(17 18)	28.1	29.2	(12 00)	240	30
SEA TEMP (DEG C)	28.5	(30 12)	29.2	30.4	(03 21)	240	30
AIR-SEA TEMP (DEG C)	-06.4	(17 18)	-01.1	00.0	(27 15)	240	30
PRESSURE (MBAR)	1011.2	(16 00)	1015.4	1018.8	(20 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	1.3	.8				2.5	8.4
NE		2.9	2.1				5.0	9.3
E	1.3	18.0	16.7				36.0	10.4
SE	.4	17.4	20.9				38.7	11.5
S	1.3	5.4	2.9				9.6	9.5
SW	1.7	2.9	.4				5.0	6.2
W	.4	2.5	2.5				5.4	9.2
NW		1.3	.4				1.7	7.8
CALM								
TOTAL	5.4	47.7	46.4				100.0	10.3

NO. OF OBS: 239

MAX WIND
SPEED: 19 KNOTS
DIRECTION: 160 DEG
DAY: 25
HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	52.5	43.0	2.5						.8M	2.0M (26 00)

OCTOBER DATA SUMMARY 42001

AVERAGE LATITUDE 25.9N AVERAGE LONGITUDE 089.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	21.2	(10 21)	25.6	28.1	(01 03)	248	31
SEA TEMP (DEG C)	25.8	(31 12)	27.7	29.1	(02 21)	248	31
AIR-SEA TEMP (DEG C)	-05.2	(30 21)	-02.0	00.8	(28 15)	248	31
PRESSURE (MBAR)	1004.9	(01 09)	1016.6	1023.9	(31 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.4	7.3	3.2			10.6	13.7
NE	.4	10.5	19.0				30.0	12.1
E	.8	14.6	10.5	.4			26.7	10.8
SE	1.2	7.7	8.7				19.6	9.7
S	.4	1.6	6.1				8.1	12.6
SW								
W		1.6					1.6	7.5
NW		.4					.4	10.0
CALM								
TOTAL	2.8	44.5	48.6	4.0			100.0	11.7

NO. OF OBS: 247

MAX WIND
SPEED: 28 KNOTS
DIRECTION: 350 DEG
DAY: 29
HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	37.1	54.4	6.9	1.6					1.0M	3.0M (30 12)

SEPTEMBER DATA SUMMARY 42002

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	25.0	(26 00)	28.2	30.0	(11 18)	236	30
SEA TEMP (DEG C)	28.2	(01 12)	29.1	31.2	(11 21)	236	30
AIR-SEA TEMP (DEG C)	-03.9	(26 00)	-00.9	00.2	(26 18)	236	30
PRESSURE (MBAR)	1009.0	(17 00)	1016.0	1018.1	(10 18)	236	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.1	3.4	.8				6.4	6.2
NE		5.1	.8				5.9	8.1
E	.4	21.2	22.4				44.0	10.9
SE	.4	11.9	13.6				25.8	10.7
S	.8	3.4	5.1				9.3	10.3
SW		3.5					3.8	6.8
W	.4	1.7	.8				5.0	8.0
NW		1.3					1.3	7.3
CALM								
TOTAL	4.2	51.7	44.1				100.0	10.0

NO. OF OBS: 236

MAX WIND
SPEED: 21 KNOTS
DIRECTION: 100 DEG
DAY: 26
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 233

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	51.5	36.5	12.0						.9M	2.5M (26 21)

OCTOBER DATA SUMMARY 42002

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	19.0	(10 12)	25.7	28.1	(01 20)	248	31
SEA TEMP (DEG C)	24.0	(31 21)	27.5	29.2	(01 00)	248	31
AIR-SEA TEMP (DEG C)	-07.4	(30 12)	-02.2	04.4	(23 15)	248	31
PRESSURE (MBAR)	1009.5	(26 00)	1016.2	1025.9	(31 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.0	3.2	12.9	3.6			21.8	15.8
NE	2.4	16.1	16.9	.4			35.9	10.7
E	.8	8.5	9.0				13.3	8.5
SE	.4	5.4	7.0	.4			13.3	12.3
S		2.8	7.3	.8			10.9	14.0
SW								
W	.4	.4					.8	9.1
NW	.4	1.2					1.6	5.5
CALM	.4						.4	.0
TOTAL	6.9	37.6	53.0	5.2			100.7	11.6

NO. OF OBS: 248

MAX WIND
SPEED: 30 KNOTS
DIRECTION: 360 DEG
DAY: 29
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 245

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	36.5	46.1	11.4	2.0	1.6				1.1M	4.5M (29 15)

SEPTEMBER DATA SUMMARY 42003

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 086.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	24.0	(18 03)	28.1	29.7	(29 18)	147	19
SEA TEMP (DEG C)	28.5	(19 03)	29.1	31.1	(15 21)	147	19
AIR-SEA TEMP (DEG C)	-04.6	(18 03)	-01.1	00.2	(29 18)	147	19
PRESSURE (MBAR)	1010.3	(30 21)	1015.1	1019.4	(19 15)	147	19

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.4	2.7					4.1	3.5
NE	1.4	11.6	6.8				19.7	9.5
E		33.3	18.4				51.7	9.4
SE	2.7	6.1	.7				9.5	6.1
S	3.4	3.4	1.4				8.2	6.5
SW	1.4	1.4	.7				3.5	6.6
W	2.0	.7					2.7	3.5
NW		.7					.7	4.0
CALM								
TOTAL	12.2	59.9	27.9				100.0	8.3

NO. OF OBS: 147

MAX WIND
SPEED: 16 KNOTS
DIRECTION: 070 DEG
DAY: 22
HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 146

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	49.3	50.7							.8M	1.5M (25 12)

OCTOBER DATA SUMMARY 42003

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 086.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	22.7	(26 12)	26.3	28.5	(28 21)	247	31
SEA TEMP (DEG C)	27.5	(22 03)	28.6	29.7	(25 21)	248	31
AIR-SEA TEMP (DEG C)	-05.7	(26 03)	-02.3	-00.1	(28 15)	247	31
PRESSURE (MBAR)	1008.7	(21 09)	1015.5	1021.6	(26 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	12.9	16.9				30.2	11.2
NE	.8	6.5	12.1				19.4	11.5
E	.4	7.7	10.1				18.5	10.7
SE	.8	4.4	9.9				15.3	11.3
S	.4	2.4	2.8				5.7	9.5
SW	.4	1.2	2.0				3.6	9.2
W	1.6	2.4	.8				4.8	5.9
NW	1.2	4.0	2.0				7.1	9.2
CALM	1.6						1.6	.0
TOTAL	8.1	41.1	50.8				105.7	10.4

NO. OF OBS: 248

MAX WIND
SPEED: 21 KNOTS
DIRECTION: 360 DEG
DAY: 31
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	36.3	57.3	6.5						1.0M	2.5M (29 03)

SEPTEMBER DATA SUMMARY 44003

AVERAGE LATITUDE 40.4N AVERAGE LONGITUDE 068.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.1	(27 15)	17.6	22.6	(06 03)	240	30
SEA TEMP (DEG C)	14.9	(30 21)	16.8	23.5	(06 03)	239	30
AIR-SEA TEMP (DEG C)	-05.4	(09 18)	00.9	06.2	(18 15)	239	30
PRESSURE (MBAR)	1005.2	(15 12)	1018.4	1028.3	(29 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		2.2					2.2	7.1
NE		8.9					8.9	7.3
E		6.7					6.7	7.4
SE		8.9					8.9	7.0
S		15.6	26.7				42.2	11.3
SW		2.2	11.1	2.2			15.6	14.6
W		2.2	2.2				4.4	10.5
NW		11.1					11.1	7.2
CALM								
TOTAL		57.8	40.0	2.2			100.0	10.2

NO. OF OBS: 45

MAX WIND
SPEED: 25 KNOTS
DIRECTION: 240 DEG
DAY: 06
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 239

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	10.0	60.6	19.7	1.7					1.4M	3.5M (27 09)

OCTOBER DATA SUMMARY 44003

AVERAGE LATITUDE 40.4N AVERAGE LONGITUDE 068.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.2	(29 18)	13.3	19.0	(04 12)	248	31
SEA TEMP (DEG C)	13.6	(31 12)	14.7	16.2	(02 09)	248	31
AIR-SEA TEMP (DEG C)	-06.9	(23 21)	-01.4	03.9	(11 18)	248	31
PRESSURE (MBAR)	1006.3	(26 03)	1015.1	1034.4	(24 15)	248	31

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	3.6	40.7	37.9	11.3	2.8	3.6			2.1M	7.5M (26 21)

SEPTEMBER DATA SUMMARY 45001
AVERAGE LATITUDE 48.0N AVERAGE LONGITUDE 087.6W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.6	(26 12)	11.2	18.6	(04 12)	239	30
SEA TEMP (DEG C)	07.9	(30 21)	11.2	15.7	(01 00)	239	30
AIR-SEA TEMP (DEG C)	-04.6	(19 06)	00.0	04.3	(04 12)	239	30
PRESSURE (MBAR)	0997.2	(16 09)	1019.6	1027.1	(26 18)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	4.6	7.1	.4			13.0	11.6
NE	.4	1.7	7.5	.4			10.0	15.0
E	1.3	2.1	7.1	.4			10.9	13.2
SE	.4	2.5	8.8	.4			12.1	14.0
S	.8	4.2	10.0				15.1	11.9
SW		5.9	3.3	.8			10.0	11.8
W	.8	5.0	12.1				18.0	12.7
NW		3.8	6.3	.4			10.5	12.7
CALM	.4						.4	.0
TOTAL	5.0	24.7	62.3	2.9			100.0	12.7

NO. OF OBS: 239
MAX WIND SPEED: 27 KNOTS DIRECTION: 230 DEG DAY: 04 HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 238

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	23.9	48.3	24.8	2.9					1.3M	3.5M (05 00)

OCTOBER DATA SUMMARY 45001
AVERAGE LATITUDE 48.0N AVERAGE LONGITUDE 087.6W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-01.7	(29 09)	04.4	11.0	(08 09)	248	31
SEA TEMP (DEG C)	03.8	(31 18)	05.8	08.1	(01 03)	248	31
AIR-SEA TEMP (DEG C)	-05.9	(04 18)	-01.4	04.0	(08 09)	248	31
PRESSURE (MBAR)	0988.9	(17 18)	1013.4	1031.4	(23 06)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	5.3	19.4	3.7			29.7	14.5
NE	.8	6.9	1.6				9.3	7.6
E		2.4	.8				3.7	9.0
SE		2.0	7.3	1.2			10.6	15.4
S	.4	3.3	5.3				8.9	11.5
SW	.4	2.1	3.7				6.9	11.8
W	.4	1.6	7.7				9.8	13.7
NW	.4	3.1	15.4	2.0			21.1	15.5
CALM								
TOTAL	3.3	27.0	61.8	6.9			100.0	13.4

NO. OF OBS: 246
MAX WIND SPEED: 26 KNOTS DIRECTION: 330 DEG DAY: 26 HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	22.2	43.5	25.4	8.5	.4				1.5M	4.6M (18 06)

SEPTEMBER DATA SUMMARY 45002
AVERAGE LATITUDE 45.3N AVERAGE LONGITUDE 086.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.9	(26 18)	14.5	20.0	(04 03)	238	30
SEA TEMP (DEG C)	13.4	(30 06)	16.2	18.7	(08 21)	238	30
AIR-SEA TEMP (DEG C)	-08.3	(26 18)	-01.7	02.8	(21 12)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	3.8	6.7	.8			11.8	13.7
NE	.8	2.1	4.6				7.6	12.1
E	.8	4.2	1.3				6.3	7.8
SE	2.1	2.5	3.4				8.0	11.2
S	.4	5.5	8.8	.4			14.7	12.3
SW	.4	8.4	13.9	2.9			25.6	14.1
W	.4	5.5	9.7	.4			16.0	13.0
NW		1.7	6.7	.8			9.2	15.1
CALM	.8						.8	.0
TOTAL	6.3	33.6	56.6	5.5			100.0	12.7

NO. OF OBS: 238
MAX WIND SPEED: 31 KNOTS DIRECTION: 200 DEG DAY: 20 HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 238

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	39.9	47.1	11.8	1.3					1.0M	3.0M (20 09)

OCTOBER DATA SUMMARY 45002
AVERAGE LATITUDE 45.3N AVERAGE LONGITUDE 086.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-00.3	(26 09)	06.7	14.3	(01 09)	247	31
SEA TEMP (DEG C)	07.7	(31 09)	10.7	13.9	(01 06)	247	31
AIR-SEA TEMP (DEG C)	-09.5	(04 15)	-04.1	02.4	(17 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		2.8	16.6	2.4			21.9	15.8
NE		3.2	5.6				8.9	11.7
E		4.3	2.0				6.3	10.1
SE		2.4	4.1	.4			8.9	12.9
S		.4	3.6	1.6			5.7	18.5
SW	.4	1.2	5.3	4.0			10.9	16.2
W		4.0	10.1	3.2			17.4	15.9
NW		3.4	10.5	4.5			22.3	16.5
CALM								
TOTAL	.4	21.9	61.5	16.2			100.0	15.6

NO. OF OBS: 246
MAX WIND SPEED: 29 KNOTS DIRECTION: 230 DEG DAY: 30 HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 246

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	25.6	51.2	21.1	2.0					1.3M	3.5M (30 21)

SEPTEMBER DATA SUMMARY 45003
AVERAGE LATITUDE 45.3N AVERAGE LONGITUDE 082.8W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.6	(26 15)	14.4	20.6	(05 00)	239	30
SEA TEMP (DEG C)	10.9	(30 15)	15.0	19.9	(01 21)	239	30
AIR-SEA TEMP (DEG C)	-06.1	(26 15)	-00.6	03.0	(21 18)	239	30
PRESSURE (MBAR)	1001.0	(21 18)	1015.9	1026.4	(28 18)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	3.8	2.9				7.1	10.2
NE	.4	1.7	3.3				5.4	11.8
E	.4	3.3	6.3				10.0	11.7
SE	.4	6.7	9.6				11.7	11.8
S	1.3	5.0	13.3	.4			20.0	12.4
SW	.8	2.9	6.3				10.0	11.3
W	.4	3.8	7.1	.8			12.1	13.2
NW	1.3	5.8	13.3	3.3			23.8	13.9
CALM								
TOTAL	5.4	32.9	57.1	4.6			100.0	12.2

NO. OF OBS: 238
MAX WIND SPEED: 28 KNOTS DIRECTION: 300 DEG DAY: 09 HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 238

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	34.0	55.0	9.2	1.7					1.1M	3.0M (26 12)

OCTOBER DATA SUMMARY 45003
AVERAGE LATITUDE 45.3N AVERAGE LONGITUDE 082.8W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-00.5	(29 12)	06.7	13.2	(01 18)	246	31
SEA TEMP (DEG C)	06.9	(31 21)	09.4	11.5	(02 21)	184	24
AIR-SEA TEMP (DEG C)	-07.6	(04 16)	-02.1	03.4	(17 18)	184	24
PRESSURE (MBAR)	0996.2	(26 09)	1013.6	1036.7	(23 15)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	4.5	6.1				10.9	12.2
NE	.4	.8	2.8				4.0	13.1
E	1.2	6.5	2.8				10.1	7.7
SE	.8	1.6	5.3				7.5	15.1
S	.8	1.6	7.5	.8			10.1	14.1
SW	.8	.4	8.9	.4			10.5	15.9
W		2.0	13.4	4.5			21.5	17.0
NW		4.0	17.0	4.5			25.5	16.0
CALM								
TOTAL	3.2	22.3	63.6	10.9			100.0	14.6

NO. OF OBS: 247
MAX WIND SPEED: 33 KNOTS DIRECTION: 280 DEG DAY: 26 HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 242

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	24.0	49.6	23.6	1.7	1.2				1.3M	4.0M (27 00)

SEPTEMBER DATA SUMMARY 45004
AVERAGE LATITUDE 47.2N AVERAGE LONGITUDE 086.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	03.1	(26 12)	12.0	19.5	(09 00)	235	30
SEA TEMP (DEG C)	07.8	(26 06)	12.2	16.5	(01 00)	235	30
AIR-SEA TEMP (DEG C)	-05.1	(26 12)	-00.1	04.2	(29 18)	235	30
PRESSURE (MBAR)	1000.3	(16 12)	1014.9	1026.9	(26 18)	235	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	5.1	5.1				11.0	10.3
NE	1.3	2.5	4.7				8.5	10.3
E	.8	5.1	6.8				12.7	10.8
SE	.8	4.2	4.2				9.3	10.2
S	.8	6.9	11.0	.4			19.6	12.3
SW	.8	1.3	4.2				6.4	11.0
W	.4	5.9	8.5	.8			15.7	12.3
NW	.8	5.5	9.7	.8			16.9	12.2
CALM	.8						.8	.0
TOTAL	7.6	36.0	54.2	2.1			100.0	11.3

NO. OF OBS: 236
MAX WIND SPEED: 24 KNOTS DIRECTION: 320 DEG DAY: 09 HOUR: 09

OCTOBER DATA SUMMARY 45004
AVERAGE LATITUDE 47.2N AVERAGE LONGITUDE 086.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-00.5	(29 12)	05.2	12.4	(17 21)	240	31
SEA TEMP (DEG C)	05.0	(31 06)	08.9	08.6	(01 18)	240	31
AIR-SEA TEMP (DEG C)	-05.9	(26 03)	-01.7	05.1	(17 21)	240	31
PRESSURE (MBAR)	0989.4	(17 21)	1013.3	1032.2	(23 09)	240	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.2	8.7	14.2			24.5	11.3
NE			4.5	.4			5.0	7.2
E		.4	3.7	1.2			5.5	7.6
SE		.4	1.2	5.2	.4		8.3	14.0
S		1.7	2.1	7.0			10.7	11.6
SW			.4	6.2	.4		7.4	14.3
W			2.1	7.0	.8		9.9	14.9
NW		.4	5.0	19.4	3.3		28.1	14.9
CALM		.8					.8	.0
TOTAL		5.4	26.1	61.6	5.0		100.0	12.6

NO. OF OBS: 242
MAX WIND SPEED: 24 KNOTS DIRECTION: 330 DEG DAY: 26 HOUR: 06

SEPTEMBER DATA SUMMARY 45005

AVERAGE LATITUDE 41.7N AVERAGE LONGITUDE 082.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.2	(27 12)	19.8	27.2	(01 21)	239	30
SEA TEMP (DEG C)	19.0	(29 12)	22.2	25.9	(03 18)	238	30
AIR-SEA TEMP (DEG C)	-08.9	(26 15)	-02.4	03.5	(20 21)	238	30
PRESSURE (MBAR)	1000.9	(17 12)	1017.2	1026.9	(27 12)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.7	4.6	6.3				12.6	10.4
NE	.4	6.7	.8				7.9	6.6
E	2.1	6.3	2.9				11.3	7.9
SE	.6	6.3	.8				7.9	7.5
S	1.3	10.0	10.5				21.8	9.8
SW		7.5	8.8				16.3	10.7
W	.8	8.4	3.3				12.6	8.3
NW	.8	5.9	2.9				9.6	9.8
CALM								
TOTAL	7.9	55.6	36.4				100.0	9.2

NO. OF OBS: 239

MAX WIND
SPEED: 21 KNOTS
DIRECTION: 320 DEG
DAY: 26
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 238

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	76.1	23.9							.6M	1.5M (26 12)

OCTOBER DATA SUMMARY 45005

AVERAGE LATITUDE 41.7N AVERAGE LONGITUDE 082.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	03.1	(27 15)	10.5	22.0	(01 21)	248	31
SEA TEMP (DEG C)	09.2	(31 18)	14.2	20.0	(01 00)	247	31
AIR-SEA TEMP (DEG C)	-11.7	(04 03)	-03.6	03.4	(17 18)	247	31
PRESSURE (MBAR)	1003.3	(02 03)	1015.9	1033.7	(23 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		2.4	2.4				4.8	9.9
NE	.8	2.4	2.4				5.6	9.8
E	.8	2.4	4.8				8.1	10.5
SE	.8	4.0	2.8				7.7	9.1
S	.4	5.6	4.0				10.1	9.6
SW	.4	2.8	14.9				18.1	12.6
W	.8	5.2	16.9	2.8			25.8	14.5
NW	1.2	7.7	10.9				19.8	11.0
CALM								
TOTAL	5.2	32.7	59.3	2.8			100.0	11.8

NO. OF OBS: 248

MAX WIND
SPEED: 24 KNOTS
DIRECTION: 290 DEG
DAY: 26
HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	47.8	49.8	2.8						.8M	2.0M (26 21)

SEPTEMBER DATA SUMMARY 46001

AVERAGE LATITUDE 56.0N AVERAGE LONGITUDE 148.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	06.7	(04 12)	10.9	12.9	(01 18)	240	30
SEA TEMP (DEG C)	10.7	(30 15)	11.2	12.3	(02 03)	240	30
AIR-SEA TEMP (DEG C)	-05.0	(04 12)	-00.3	01.6	(13 18)	240	30
PRESSURE (MBAR)	0957.6	(29 03)	1007.6	1030.3	(14 21)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			1.3				1.3	16.0
NE			1.7	.8			2.9	18.4
E		1.3	9.6	2.5			13.3	16.7
SE		.8	4.2				5.0	14.1
S		4.2	18.8				22.9	13.9
SW		3.3	18.8	1.3			23.3	15.2
W	.4	2.9	16.7	2.5			22.5	15.4
NW		.4	4.6	3.8			8.8	19.0
CALM								
TOTAL	.4	13.3	75.4	10.8			100.0	15.6

NO. OF OBS: 240

MAX WIND
SPEED: 28 KNOTS
DIRECTION: 030 DEG
DAY: 28
HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 238

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		21.8	39.5	27.7	10.5	.4			2.5M	6.0M (29 00)

OCTOBER DATA SUMMARY 46001

AVERAGE LATITUDE 56.0N AVERAGE LONGITUDE 148.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	03.2	(10 18)	08.1	10.6	(06 00)	248	31
SEA TEMP (DEG C)	08.0	(31 21)	09.3	10.9	(01 00)	248	31
AIR-SEA TEMP (DEG C)	-06.4	(10 18)	-01.2	01.0	(21 21)	248	31
PRESSURE (MBAR)	0974.1	(07 00)	0998.4	1022.0	(29 21)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.6	.8	2.8	2.8			8.1	15.4
NE		.4	2.8	2.0			5.3	19.7
E		.4	3.6	3.2	.4		11.7	18.7
SE		.6	3.2	10.1	3.6		17.8	15.6
S		.4	5.3	8.1	2.0		15.8	14.1
SW		1.2	4.9	8.9	1.6		16.6	12.9
W		.4	7.3	8.1	1.6		17.4	13.0
NW		.8	7.4	3.6	.4		7.3	11.5
CALM								
TOTAL		5.7	27.9	47.8	16.6		100.0	14.5

NO. OF OBS: 247

MAX WIND
SPEED: 32 KNOTS
DIRECTION: 090 DEG
DAY: 22
HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 244

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		12.8	33.6	27.4	20.2	5.2	.8		3.2M	6.5M (22 06)

SEPTEMBER DATA SUMMARY 46002

AVERAGE LATITUDE 42.5N AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	14.0	(20 21)	16.5	18.3	(05 09)	236	30
SEA TEMP (DEG C)	17.2	(28 18)	17.7	18.7	(05 21)	236	30
AIR-SEA TEMP (DEG C)	-03.8	(20 21)	-01.2	00.6	(29 21)	236	30
PRESSURE (MBAR)	1004.8	(28 00)	1018.9	1027.9	(22 18)	236	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		5.5	38.6	2.1			46.2	15.1
NE		3.8	7.2				11.0	12.4
E		1.7	2.1				3.8	12.1
SE			.4				.4	11.0
S		1.3	5.5				6.8	13.5
SW		2.5	4.7				7.2	12.5
W		5.1	5.1	.4			10.6	11.4
NW	1.3	6.4	5.9	.4			14.0	11.1
CALM								
TOTAL	1.3	26.3	69.5	3.0			100.0	13.4

NO. OF OBS: 236

MAX WIND
SPEED: 28 KNOTS
DIRECTION: 280 DEG
DAY: 26
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 236

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	1.3	30.4	30.9	12.7	9.7				1.9M	4.5M (30 18)

OCTOBER DATA SUMMARY 46002

AVERAGE LATITUDE 42.5N AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	12.9	(24 15)	15.8	18.4	(07 00)	248	31
SEA TEMP (DEG C)	15.8	(28 09)	16.9	18.5	(07 00)	248	31
AIR-SEA TEMP (DEG C)	-01.3	(24 15)	-01.1	01.2	(31 21)	248	31
PRESSURE (MBAR)	0999.0	(31 21)	1016.2	1029.0	(08 18)	248	31

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		14.2	37.7	27.9	16.6	4.0			2.9M	7.0M (08 15)

SEPTEMBER DATA SUMMARY 46003

AVERAGE LATITUDE 52.0N AVERAGE LONGITUDE 156.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.7	(29 21)	10.8	14.3	(13 09)	237	30
SEA TEMP (DEG C)	11.2	(26 18)	11.8	12.3	(06 06)	238	30
AIR-SEA TEMP (DEG C)	-03.6	(29 21)	-01.0	02.4	(13 09)	237	30
PRESSURE (MBAR)	0978.6	(29 21)	1009.8	1029.0	(16 09)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			4.2	7.1			11.3	12.2
NE		.8	.8	3.4	.4		5.0	12.5
E		.4	.4	1.3	1.3	.4	3.8	18.9
SE			2.1	1.7	2.1		5.9	15.0
S	1.3		.8	7.6	12.2		21.8	20.9
SW		.4	2.1	13.4	7.6		23.5	18.4
W		.8	2.9	10.1	3.8		17.6	16.8
NW		.4	1.3	7.6	1.7		10.9	16.8
CALM								
TOTAL	1.3	1.7	52.1	29.0	.4		100.0	17.3

NO. OF OBS: 238

MAX WIND
SPEED: 34 KNOTS
DIRECTION: 090 DEG
DAY: 18
HOUR: 18

OCTOBER DATA SUMMARY 46003

AVERAGE LATITUDE 52.0N AVERAGE LONGITUDE 156.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	02.6	(24 12)	07.1	11.0	(04 00)	246	31
SEA TEMP (DEG C)	07.6	(29 12)	09.4	11.7	(01 03)	245	31
AIR-SEA TEMP (DEG C)	-05.7	(06 03)	-02.3	00.4	(28 21)	245	31
PRESSURE (MBAR)	0969.2	(06 15)	0998.4	1020.9	(10 06)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.6	6.6	3.7	.8		12.8	19.1
NE			.4	2.5	.4	1.2	4.5	23.3
E			.8	4.9	2.5	1.2	9.5	20.8
SE			.8	1.6	2.5		4.9	20.8
S		1.6	5.3	5.3	1.2		14.4	21.2
SW		1.2	7.4	5.6			14.4	19.2
W			.8	14.4	9.1	3.3	27.6	21.9
NW			.8	5.8	4.1	1.2	11.9	21.1
CALM								
TOTAL		4.2	49.0	33.7	9.1		100.0	20.9

MAX WIND
SPEED: 39 KNOTS
DIRECTION: 030 DEG
DAY: 26
HOUR: 15

SEPTEMBER D A T A S U M M A R Y 46004

AVERAGE LATITUDE 51.0N AVERAGE LONGITUDE 136.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.3	(19 06)	13.2	15.1	(28 15)	236	30
SEA TEMP (DEG C)	12.8	(29 15)	13.2	13.9	(10 00)	236	30
AIR-SEA TEMP (DEG C)	-02.0	(19 06)	00.1	02.0	(29 00)	236	30
PRESSURE (MBAR)	0985.6	(28 15)	1018.5	1036.0	(14 06)	236	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.3	5.5	3.4	3.8		14.0	13.8
NE		.8	1.3				2.1	4.2
E			.4				.8	4.0
SE		.8	.4	3.8	.8		5.9	15.9
S			4.2	8.5	5.9	.8	19.5	18.2
SW			1.3	9.3	3.0		13.6	17.7
W		.4	2.5	13.1	8.4	1.3	25.7	18.5
NW			.4	14.0	5.9	.4	20.8	16.9
CALM								
TOTAL		3.4	16.1	52.1	25.8	2.5	100.0	17.2

MAX WIND
SPEED: 42 KNOTS
DIRECTION: 270 DEG
DAY: 19
HOUR: 15

NO. OF OBS: 236

OCTOBER D A T A S U M M A R Y 46004

AVERAGE LATITUDE 51.0N AVERAGE LONGITUDE 136.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.1	(25 15)	11.9	15.0	(01 16)	248	31
SEA TEMP (DEG C)	10.9	(29 15)	12.0	13.2	(06 03)	248	31
AIR-SEA TEMP (DEG C)	-03.6	(10 21)	-00.1	02.3	(23 21)	248	31
PRESSURE (MBAR)	0967.5	(31 09)	1012.9	1032.7	(08 21)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.4	1.6	2.4			4.4	11.8
NE				.4	.4		.8	21.0
E			1.2	1.6	1.6	.4	4.8	19.3
SE		.4		1.2	7.3	6.0	14.9	29.2
S		.8	.4	27.2	19.8	.8	41.9	21.4
SW			.4	9.7	5.0	.4	16.5	20.1
W			1.6	7.3	5.6		14.5	19.3
NW		.4		1.2			1.6	13.0
CALM		.4					.4	.0
TOTAL		2.4	5.2	44.6	40.7	7.7	100.7	21.3

MAX WIND
SPEED: 43 KNOTS
DIRECTION: 140 DEG
DAY: 23
HOUR: 16

NO. OF OBS: 248

SEPTEMBER D A T A S U M M A R Y 46005

AVERAGE LATITUDE 46.0N AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	13.6	(25 15)	15.0	16.8	(28 21)	236	30
SEA TEMP (DEG C)	14.6	(24 06)	15.5	15.9	(11 18)	214	30
AIR-SEA TEMP (DEG C)	-02.1	(10 15)	-00.5	01.7	(28 21)	214	30
PRESSURE (MBAR)	1003.3	(06 06)	1017.6	1027.8	(23 18)	236	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.4	12.3	15.7	3.8		32.2	13.3
NE		.4	3.4	3.4			7.2	9.3
E								
SE		.4					.4	2.0
S				.4	4.7	1.7	6.8	18.6
SW		.4	1.3	10.2	.8		12.7	14.7
W		.4	7.2	9.7			17.4	11.5
NW		.8	10.6	11.0	.8		23.3	11.7
CALM								
TOTAL		3.0	35.2	54.7	7.2		100.0	12.8

MAX WIND
SPEED: 29 KNOTS
DIRECTION: 340 DEG
DAY: 14
HOUR: 00

NO. OF OBS: 236

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		51.3	26.7	11.0	11.0				2.1M	5.0M (29 18)

NO. OF WAVE OBS: 236

OCTOBER D A T A S U M M A R Y 46005

AVERAGE LATITUDE 46.0N AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	10.6	(29 12)	14.4	16.9	(05 06)	248	31
SEA TEMP (DEG C)	10.5	(02 21)	15.1	16.0	(07 03)	247	31
AIR-SEA TEMP (DEG C)	-04.0	(25 12)	-00.7	05.7	(02 21)	247	31
PRESSURE (MBAR)	0989.0	(31 21)	1015.8	1031.4	(06 21)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.8	2.8	2.8	1.2		7.7	11.7
NE			1.2	2.8			4.0	10.2
E			.4	1.2			1.6	9.6
SE		.4	1.2	3.2	1.6		6.5	14.1
S		.4	1.6	27.0	7.3		31.5	16.9
SW			2.4	10.9	1.2		14.5	12.7
W		.8	4.5	7.7	2.0		15.3	13.1
NW		.4	2.0	7.7	1.6		12.5	13.9
CALM								
TOTAL		2.8	17.4	63.5	14.9		100.0	14.2

MAX WIND
SPEED: 29 KNOTS
DIRECTION: 170 DEG
DAY: 05
HOUR: 06

NO. OF OBS: 248

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		10.1	35.7	30.6	19.0	1.6			2.9M	6.5M (06 09)

NO. OF WAVE OBS: 248

SEPTEMBER D A T A S U M M A R Y 46010

AVERAGE LATITUDE 46.2N AVERAGE LONGITUDE 124.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.3	(26 15)	13.7	20.1	(26 00)	235	30
SEA TEMP (DEG C)	10.9	(25 06)	13.4	16.2	(08 21)	235	30
AIR-SEA TEMP (DEG C)	-02.7	(06 09)	00.3	06.3	(26 03)	235	30
PRESSURE (MBAR)	1007.1	(26 03)	1017.3	1026.6	(30 21)	235	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			8.1	32.6			40.7	12.6
NE			2.3	1.2			3.5	10.0
E			1.2				1.2	10.0
SE		1.2	1.2	1.2			3.5	8.0
S			2.3	16.3			18.6	14.9
SW			1.2	5.6			7.0	10.7
W			5.8	2.3			8.1	8.9
NW			7.0	8.1			15.1	10.2
CALM		2.3					2.3	.0
TOTAL		3.5	29.1	67.4			100.0	11.7

MAX WIND
SPEED: 21 KNOTS
DIRECTION: 180 DEG
DAY: 06
HOUR: 21

NO. OF OBS: 86

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	1.3	70.1	20.9	6.4	1.3				1.6M	4.0M (30 06)

NO. OF WAVE OBS: 234

OCTOBER D A T A S U M M A R Y 46010

AVERAGE LATITUDE 45.7N AVERAGE LONGITUDE 124.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.3	(16 15)	12.8	22.0	(05 00)	245	31
SEA TEMP (DEG C)	10.1	(29 06)	12.6	14.9	(07 00)	245	31
AIR-SEA TEMP (DEG C)	-02.0	(17 09)	00.2	08.7	(03 00)	245	31
PRESSURE (MBAR)	1006.9	(12 15)	1019.1	1030.1	(28 06)	245	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			2.8	1.6			4.2	9.3
NE			5.6	11.3			16.9	14.5
E		1.6	7.4	6.8			15.2	12.4
SE			5.6	16.9	9.9		32.4	17.3
S			4.2	2.8			7.0	10.5
SW								
W			4.2				4.2	6.0
NW								
CALM								
TOTAL		1.6	29.6	39.2	9.9		100.7	13.8

MAX WIND
SPEED: 26 KNOTS
DIRECTION: 130 DEG
DAY: 31
HOUR: 12

NO. OF OBS: 71

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	.4	36.1	37.7	20.9	4.9				2.2M	5.0M (09 06)

NO. OF WAVE OBS: 244

SEPTEMBER D A T A S U M M A R Y 46005

AVERAGE LATITUDE 31.7N AVERAGE LONGITUDE 079.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.3	(09 06)	27.6	29.3	(02 15)	193	25
SEA TEMP (DEG C)	26.4	(07 21)	28.1	29.2	(08 18)	190	25
AIR-SEA TEMP (DEG C)	-05.0	(09 06)	-00.5	01.5	(19 12)	190	25
PRESSURE (MBAR)	1011.0	(15 21)	1017.7	1023.0	(19 15)	193	25

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.5	6.7				7.3	9.7
NE		1.6	4.8	1.6			13.0	9.6
E		2.1	11.9	9.8			23.8	9.6
SE		1.6	8.6	2.1			12.4	7.5
S		3.1	4.7	1.0			8.9	5.5
SW		1.6	3.1				4.7	4.7
W		4.1	8.5	2.6			15.5	6.8
NW		2.1	6.7	5.7			14.5	8.6
CALM								
TOTAL		16.5	60.6	22.8			100.0	7.7

MAX WIND
SPEED: 17 KNOTS
DIRECTION: 080 DEG
DAY: 17
HOUR: 06

NO. OF OBS: 193

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	25.0	73.4	1.6						1.0M	2.0M (13 06)

NO. OF WAVE OBS: 192

OCTOBER D A T A S U M M A R Y 42008

AVERAGE LATITUDE 28.7N AVERAGE LONGITUDE 095.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	19.9	(29 15)	26.9	31.0	(17 18)	231	31
SEA TEMP (DEG C)	20.9	(31 15)	25.7	29.2	(02 21)	231	31
AIR-SEA TEMP (DEG C)	-07.7	(01 12)	01.2	06.2	(28 03)	231	31
PRESSURE (MBAR)	1006.9	(27 21)	1016.0	1031.2	(30 15)	231	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.3	6.5	14.7	5.2		27.6	14.5
NE		1.6	7.6	6.0			15.8	10.3
E		1.7	6.9	3.9			12.5	8.9
SE		.9	6.9	10.3	.9		18.5	12.5
S		.9	3.0	8.2	1.3		12.9	13.4
SW		.4	1.7	3.0			5.2	9.7
W		.4	1.7	.9			3.0	7.8
NW		.4	3.4	2.6			6.5	10.7
CALM								
TOTAL		5.6	37.9	49.6	6.9		100.0	12.0

MAX WIND
SPEED: 29 KNOTS
DIRECTION: 340 DEG
DAY: 29
HOUR: 09

Continued on page 129.

Selected Gale and Wave Observations, North Atlantic

September and October 1980

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves Period sec.	Sea Waves Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.	Swell Waves Height ft.
NORTH ATLANTIC OCEAN		SEP.															
DRUCILLA U	ELMN	8	31.1 N	39.9 W	12	12	45	2 NM	95	1019.0	27.0	25.0	6	10	12	7	13
AMERICAN RANGER	KNKW	8	45.3 N	52.3 W	12	02	45	200 YD	81	0998.9	13.3	13.7	3	13	03	< 6	14.5
AMERICAN RACER	KNOF	12	55.5 N	07.6 W	12	27	45	5 NM	02	0997.0	13.3	13.7	1	6.5	27	9	19.5
AMERICAN ARGOSY	KFCX	16	45.0 N	42.5 W	12	23	50	.5 NM	45	1000.0	19.4	16.9	5	13	21	7	24.5
SEALAND MARKET	KJVG	17	48.8 N	40.6 W	00	27	55	200 YD	45	0988.8	11.0	12.8					
AMERICAN LEADER	KFFJ	17	48.0 N	35.8 W	18	34	35	10 NM	02	1002.0	13.0	13.9	15	32.5	30	>13	29.5
DEL MONTE	WNWW	18	10.9 N	33.1 W	12	16	45	2 NM	61	1013.1	23.9	27.2	5	5	16	< 6	11.5
SEALAND PIONEER	WSVB	18	40.2 N	47.2 W	14	07	50	2 NM	63	1007.4	22.2	21.0	2	19.5	04	< 6	26
RED JACKET	KAAJ	19	42.7 N	44.2 W	09	16	41	2 NM	21	1006.1	22.8	20.6			XX		19.5
AMERICAN LEGEND	KFEY	20	43.1 N	51.6 W	18	36	45	10 NM	02	1015.2	13.4	15.0	6	11.5	36	7	11.5
BARRANCA	GPEY	22	20.1 N	84.5 W	18	11	34	5 NM	63	1012.2	27.0	33.0	5	11.5	12	< 6	32.5
GREAT LAKES VESSELS																	
IRVING S OLDS	9819	4	47.6 N	88.0 W	18	25	M 45	> 25 NM	02		18.0	16.0		8			
WILLIAM CLAY FORD	9888	5	47.5 N	87.9 W	00	26	M 46	> 25 NM	03		20.0	17.0	4	10			
JOHN DYKSTRA	9852	9	47.1 N	86.0 W	06	20	M 44	5 NM	97		16.0	16.0	7	6.5			
EDWIN H GOTT	9971	20	43.9 N	86.6 W	06	18	M 42	5 NM	29		17.0						
HENRY FORD II	9892	20	44.2 N	82.7 W	12	19	M 42	10 NM	03		26.0	17.0		3			
LEON FRASER	9827	26	47.6 N	85.5 W	00	02	M 45	5 NM	63		4.0	10.0		8			
JOHN DYKSTRA	9852	26	45.3 N	83.2 W	06	29	M 44	10 NM	25		12.0	12.0	6	5			
		OCT.															
GULF SHIPPER	KEMP	1	40.9 N	42.7 W	18	22	60	2 NM	60	1009.5	21.7	19.4	4	6.5	24	< 6	8
AMERICAN ACE	KFCV	2	46.4 N	34.8 W	12	34	45	2 NM	50	1006.0	13.4	15.6	6	18	34	6	18
GULF SHIPPER	KEMP	4	36.1 N	63.8 W	06	16	45	10 NM	01	1015.0	25.0	23.9					
TFL EXPRESS	9VPU	5	50.6 N	10.5 W	11	26	M 44	10 NM	02	1018.6	15.0	16.0	4	3	27	6	8
TFL EXPRESS	9VPU	6	48.9 N	19.9 W	11	27	M 49	2 NM	60	1009.7	16.5	16.4			25	7	10
AMERICAN RANGER	KNKW	6	50.6 N	13.1 W	18	29	41	5 NM	21	0997.0	15.0	12.2	7	14.5	27	13	18
AMERICAN RANGER	KNKW	7	50.4 N	18.0 W	12	31	45	5 NM	01	1001.2	11.2	12.3	5	18	29	>13	26
RESOLUTE	KFDZ	8	47.5 N	11.7 W	18	29	45	10 NM	02	1010.5	10.6	16.7	6	13	29	13	19.5
SNOW STORM	SGXA	10	37.4 N	38.5 W	09	14	55	.5 NM	06	1001.0	24.0	23.5	9	16.5	17	12	16.5
GULF SHIPPER	KEMP	13	49.6 N	39.0 W	18	12	42	10 NM	02	1014.5	16.7	17.3	4	8	09	< 6	6.5
GULF SHIPPER	KEMP	14	46.8 N	36.4 W	00	14	50	1 NM	05	1017.2	16.6	14.4	10	13	14	12	16.5
GULF SHIPPER	KEMP	15	48.5 N	21.3 W	12	02	50	5 NM	03	1019.2	15.0	13.4	10	13	36	12	16.5
GULF SHIPPER	KEMP	16	49.0 N	14.7 W	06	04	50	> 25 NM	01	1010.0	10.6	12.2	10	16.5	03	12	21
CERESIO	6ZHT	16	50.3 N	13.6 W	12	36	M 46	5 NM	02	1011.2	14.3	14.0	7	10	05	13	16.5
GULF SHIPPER	KEMP	17	49.6 N	06.7 W	06	02	45	10 NM	02	1000.0	8.9	12.3	4	8	02	12	16.5
BUYER	KCAO	17	36.0 N	43.4 W	12	36	45	5 NM	18	1015.9	18.3	23.9	7	13	36	10	26
CERESIO	6ZHT	17	52.3 N	05.8 W	18	36	M 44	5 NM	01	1000.3	11.2	14.0	6	8	36	6	16.5
SEALAND MARKET	KJVG	18	41.3 N	31.4 W	12	25	45	10 NM	01	0999.7	20.0	18.8	5	5	20	9	6.5
SEALAND PIONEER	WSVB	18	36.8 N	38.9 W	18	30	M 43	5 NM	01	1005.2	19.0	23.0	8	19.5			
EXPORT LEADER	WCJV	19	48.6 N	37.5 W	12	33	50	2 NM	42	0999.4	10.0	15.6	4	23	34	9	36
EXPORT LEADER	WCJV	20	47.5 N	42.4 W	00	26	41	5 NM	02	0999.9	12.2	18.3	4	10	25		13
AMERICAN LEGEND	KFEY	25	47.9 N	31.0 W	06	25	48	5 NM	02	0984.5	11.5	14.0	8	10	25	>13	24.5
AMERICAN ARCHER	KFCS	25	45.6 N	43.6 W	12	30	45	5 NM	81	1001.2	8.3	18.9	3	14.5	30	6	29.5
AMERICAN ARGOSY	KFCX	25	46.5 N	47.5 W	12	32	45	5 NM	03	1014.0	5.6	5.6	8	23	32	9	19.5
AMERICAN ACCORD	KFEZ	25	49.3 N	39.2 W	18	31	56	5 NM	62	0984.1	8.9	14.0	14	46	31		42.5
STAGHOUND	KAFQ	25	45.8 N	48.4 W	18	32	42	10 NM	01	1019.0	5.8	7.3	5	8	31	10	18
SEALAND RESOURCE	WJKD	25	45.0 N	29.9 W	18	23	45	10 NM	02	0998.0	14.2	14.0	4	10	23	7	16.5
KENNETH E HILL	DSOD	25	34.5 N	74.8 W	18	24	M 42	5 NM	25	1006.0	24.0		9	11.5			
AMERICAN LEGEND	KFEY	26	48.2 N	25.7 W	00	22	45	5 NM	01	0993.0	14.5	14.5	9	16.5	22	>13	26
AMERICAN ACCORD	KFEZ	26	50.3 N	40.8 W	06	33	54	5 NM	50	1001.0	7.3	12.6	14	44			
SEALAND RESOURCE	WJKD	26	43.4 N	33.3 W	06	28	45	10 NM	15	1002.5	12.5	14.5	5	11.5	27	7	16.5
AMERICAN ARGOSY	KFCX	26	47.3 N	38.3 W	12	33	50	5 NM	25	1004.0	11.7	13.9	9	29.5			
STAGHOUND	KAFQ	27	42.6 N	63.1 W	18	27	50	10 NM	25	1012.0	10.6	14.5	5	8	27	10	21
AMERICAN ACCORD	KFEZ	28	45.0 N	56.2 W	12	28	42	> 25 NM	01	1015.0	5.5	8.3	8	16.5			
JUTHLANDIA	ELXV	29	58.4 N	02.5 W	06	29	41	5 NM	20	0995.8	8.0	7.2	8	6.5	XX		8
GULF SHIPPER	KEMP	29	39.8 N	55.8 W	12	23	50	5 NM	03	1010.8	22.2	21.2	6	10	23	10	16.5
AMERICAN RANGER	KNKW	30	45.9 N	33.7 W	12	20	50	1 NM	21	0993.0	16.2	12.2	6	13	22	7	14.5
AMERICAN LEGACY	KFGJ	30	49.2 N	28.1 W	17	27	45	.25 NM	65	0986.2	13.3	15.0	XX	16.5	XX		16.5
FALSTRIA	GYRG	30	47.8 N	25.9 W	18	18	M 41	5 NM	02	0991.0	15.8	14.0	6	13			
JUTHLANDIA	ELXV	31	58.1 N	20.7 W	00	17	47	2 NM	63	0997.9	12.0	6.9			17	7	18
GREAT LAKES VESSELS																	
MESABI MINER	9887	3	42.1 N	87.4 W	00	32	M 44	10 NM	18		11.0	14.0	2	5			
ARTHUR M ANDERSON	9863	12	48.2 N	87.7 W	00	01	M 42	10 NM	02		- 2.0	9.0		11.5			
GEORGE M HUMPHREY	9816	18	47.1 N	90.8 W	00	23	M 47	10 NM	18		4.0	11.0	4	11.5			
JOHN DYKSTRA	9852	18	47.1 N	86.0 W	06	21	M 50	10 NM	02		6.0	8.0	8	8			
JOHN DYKSTRA	9852	24	47.5 N	88.1 W	06	16	M 50	10 NM	02		7.0	8.0	6	8			
JOHN DYKSTRA	9852	26	47.6 N	88.2 W	00	33	M 41	5 NM	70		3.0	6.0	8	10			
JOHN G MUNSON	9882	26	46.6 N	84.9 W	12	31	M 42	5 NM	75		- 1.0	- 1.0		10			
GEORGE A SLOAN	9817	26	45.3 N	83.4 W	12	30	M 45	10 NM	02		4.0	6.0		8			
GEORGE A SLOAN	9817	27	45.3 N	83.4 W	00	29	M 45	10 NM	02		4.0	6.0		10			
CASON J CALLAWAY	9841	31	47.3 N	89.8 W	12	28	M 42	10 NM	01		4.0	7.0	9	11.5			
PETROMARTIAL BUOY 44004		25	39.0 N	070.0 W	17	11	M 45			1009.6	18.8	21.3	3	11			

+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

Selected Gale and Wave Observations, North Pacific

September and October 1980

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10s	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves? Period sec.	Sea Waves? Height ft.	Swell Waves Dir. 10s	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		SEP.															
PRESIDENT ADAMS	KAAV	1	40.4 N	153.1 E	00	09	45	2 NM	07	1006.4	19.5	19.4	6	16.5	09	8	19.5
PORTLAND	WNDF	8	53.1 N	137.7 W	00	18	42	5 NM	53	1015.2	11.7	13.5	6	10	23	12	13
SEALAND FINANCE	WJKG	10	26.6 N	126.6 E	00	29	45	5 NM	01	0999.7	25.0	26.7	6	10	29	8	14.5
LNG CAPRICORN	KHLN	10	24.9 N	129.2 E	10	26	M 48	2 NM	42	0980.7	29.0	30.0	8	13	28	>13	19.5
SEALAND TRADE	WEUI	10	29.0 N	127.9 E	12	34	68	200 YD	07	0980.0	25.6	28.3	6	18			
SIENA	GXFU	10	28.5 N	128.0 E	12	34	M 60	.25 NM	61	0982.0	26.2	28.0	6	26			
NEPTUNE DIAMOND	9VYT	10	30.5 N	125.9 E	12	35	M 47	5 NM	02	0995.4	23.1						
PRESIDENT JOHNSON	WYMS	10	33.8 N	134.9 E	18	12	45	10 NM	25	0996.0	27.8	26.7	5	13	15	8	19.5
HONSHU GLORIA	A8PJ	10	46.7 N	151.7 W	18	05	M 50	50 YD	32	1012.0	12.0	12.0	5	23			
PRESIDENT JOHNSON	WYMS	11	33.4 N	135.6 E	00	16	50	5 NM	03	0996.8	28.3	28.9	7	13	17	10	16.5
NORTHERN VICTORY	S6AD	11	32.6 N	137.0 E	00	15	M 46	5 NM	02	1002.5	30.0	30.5	6	13	15	9	16.5
SEALAND TRADE	WEUI	11	29.9 N	127.6 E	00	33	53	2 NM	07	0991.5	23.3	26.7	6	19.5			
HONSHU GLORIA	A8PJ	11	48.1 N	148.1 W	06	07	M 35	50 YD	30	1013.0	16.0	15.0	5	19.5	22	7	32.5
MUNRO WHEC 724	WGDF	12	56.3 N	169.4 W	04	08	M 53	1 NM	63	0992.0	7.8		7	18			
RUSH WHEC 723	NLVS	12	52.7 N	171.9 W	06	12	45	10 NM	10	0965.8	7.9	6.1	XX	6.5	07	< 6	23
RUSH WHEC 723	NLVS	13	52.4 N	172.3 W	00	14	52	5 NM	10	0982.6	10.6	5.0	XX	3	18	< 6	6.5
BELLMAN	9VUP	14	46.0 N	160.8 W	00	16	M 42	5 NM	02	1012.5	19.1	14.0	4	11.5	16	7	16.5
KARINITA	LJRI	14	41.0 N	164.0 W	18	17	M 42	5 NM	51	1010.5	22.0		17	32.5			
KARINITA	LJRI	15	46.9 N	162.0 W	00	15	M 40	5 NM	01	1017.0	23.0		14	32.5			
NEWARK	WNDO	15	52.9 N	134.2 W	12	34	M 45	5 NM	10	1024.0	12.2	12.2	5	13	34	7	16.5
PRESIDENT MADISON	WCTP	15	51.8 N	137.3 W	18	32	45	1 NM	41	1027.1	13.4	12.8	6	8	30	10	10
NEPTUNE AMBER	S6CY	16	42.7 N	171.6 E	00	11	M 45	2 NM	63	1001.5	14.5	14.1	4	6.5	12	8	13
LNG AQUARIUS	WSKJ	17	24.3 N	127.3 E	06	08	M 42	5 NM	16	1000.7	24.2	26.9					
AMERICAN AQUARIUS	WYRI	18	25.2 N	121.0 E	22	03	45	5 NM	02	1001.5	23.3	25.0	8	19.5	02	>13	11.5
AMERICAN AQUARIUS	WYRI	19	25.4 N	121.3 E	00	03	45	5 NM	62	1003.0	23.8	25.5	6	24.5	03	8	19.5
RUSH WHEC 723	NLVS	19	53.8 N	140.0 W	12	27	45	1 NM	21	0994.8	12.3	12.2	XX	10	26	6	19.5
SOHIO INTREPID	KACK	19	50.8 N	134.5 W	18	29	45	2 NM	80	0997.3	12.8	11.7	2	5	29	10	24.5
KARINITA	LJRI	20	26.3 N	120.5 W	06	05	M 45	> 25 NM	03	1014.0	19.0		18	11.5			
NEPTUNE CRYSTAL	9VNW	20	49.9 N	129.1 W	18	32	M 44	10 NM	01	1012.0	13.4	13.7	6	10	29	10	19.5
NEPTUNE CRYSTAL	9VNW	21	51.9 N	138.4 W	12	24	M 42	5 NM	03	1014.2	13.0	11.8					
NEPTUNE CRYSTAL	9VNW	22	53.8 N	152.2 W	18	18	M 41	10 NM	02	1012.1	11.0	10.7	5	6.5	21	7	10
NEPTUNE CRYSTAL	9VNW	23	54.1 N	161.4 W	12	27	M 47	5 NM	02	1011.8	9.0	8.6					
GOLDEN GATE BRIDGE	JP2D	24	40.1 N	152.7 W	18	16	M 42	5 NM	15	1006.8	21.0	21.0	2	6.5	14	< 6	14.5
NEPTUNE CRYSTAL	9VNW	25	51.8 N	174.0 E	12	26	M 43	5 NM	02	1002.6	9.8	8.2					
NEPTUNE CRYSTAL	9VNW	26	50.3 N	168.8 E	00	28	M 50	10 NM	01	1002.5	11.0	9.3	5	6.5	28	10	16.5
BUNGA MELAWIS	9MUT	26	46.6 N	166.6 E	18	27	M 43	5 NM	03	0993.0	12.0	11.5	8	13	25	7	11.5
ALASKA STANDARD	WHDN	26	59.3 N	149.3 W	18	10	45	2 NM	60	0994.5	11.0	10.7	4	23	11	< 6	19.5
DIAMOND PHOENIX	DSMS	26	46.5 N	166.4 E	18	31	M 47	2 NM	02	0996.5	11.0	14.0	5	11.5	31	8	16.5
PACBARON	ABYI	26	54.0 N	162.2 W	18	27	M 49	.5 NM	58	0972.0	8.0	10.0		16.5	27	12	16.5
OCTA	ABOG	26	46.7 N	165.5 E	18	25	M 41	5 NM	03	0998.0	12.0	14.0	5	19.5			
ALASKA STANDARD	WHDN	27	59.5 N	149.0 W	00	07	55	2 NM	63	0990.5	9.5	10.0	5	19.5	09	7	26
PACBARON	ABYI	27	54.5 N	163.2 W	04	23	M 46	.5 NM	58	0970.0	8.0	10.0		14.5	23	12	14.5
POLAR ALASKA	SLEU	27	54.1 N	162.2 W	18	27	M 50	5 NM	02	0997.9	9.0	7.0	5	8			
VELMA LYKES	KVMU	27	35.0 N	140.9 E	12	02	41	5 NM	53	1006.0	19.4	24.4			20	11	19.5
PAN ASIA	3FYN	28	44.4 N	142.7 W	00	18	M 48	.5 NM	62	0995.0	18.0	19.0	3	14.5	18	8	16.5
PACMERCHANT	5MCB	28	47.3 N	145.1 W	00	17	M 43	1 NM	41	0978.5	11.0	15.0	XX	19.5	15	12	32.5
OJI GLORIA	5LTW	28	51.3 N	143.1 W	06	14	M 50	.5 NM	66	0966.0	14.0	14.5	6	23	14	7	14.5
SEALAND EXCHANGE	KFOU	28	36.9 N	143.6 E	06	05	45	10 NM	02	1012.5	17.2	24.4	6	8	04	6	19.5
JAPAN ACE	JKFS	28	39.4 N	158.2 W	06	18	M 43	5 NM	01	1002.5	19.0	21.0	4	11.5	17	< 6	13
HARUNA MARU	JJKG	28	43.1 N	156.0 W	06	25	M 50	2 NM	21	0989.0	16.0	20.0	9	23			
PERENNIAL ACE	HOMQ	28	52.3 N	148.3 W	09	36	M 44	.25 NM	65	0961.5	11.0	12.5					
EXXON SAN FRANCISCO	KAAC	28	55.5 N	140.1 W	12	12	45	10 NM	02	0975.3	12.0	10.6	9	18			
ARCO JUNEAU	KSBG	28	50.3 N	134.6 W	12	16	M 51	10 NM	63	0988.0	12.8						
AMERICAN AQUARIUS	WYRI	28	45.1 N	149.0 W	12	25	43	10 NM	13	0985.0	15.0	15.6	5	19.5	28	7	18
PRINCE WILLIAM SOUND	WSDX	28	53.8 N	139.6 W	12	14	M 65	2 NM	61	0972.0	12.2	13.3	8	16.5	14	12	26
AMERICA SUN	WNEJ	28	53.1 N	137.0 W	12	13	M 43	5 NM	65	0983.2	11.1	12.8	1	6.5	13	< 6	13
AMERICAN AQUARIUS	WYRI	29	43.9 N	142.8 W	00	26	41	10 NM	15	0999.1	18.9	16.1	5	16.5	26	7	19.5
ARCO CALIFORNIA	WMCV	29	58.5 N	144.3 W	00	10	M 60	5 NM	07	0970.9	10.0	10.5	4	3	10	12	36
EXXON SAN FRANCISCO	KAAC	29	54.9 N	139.1 W	00	15	45	10 NM	01	0976.5	14.0	11.4	9	19.5			
SEALAND EXPLORER	WGJF	29	46.7 N	164.5 W	06	29	M 43	10 NM	02	0999.7	12.5	10.0	7	6.5	29	7	10
WESTWARD VENTURE	KHJB	29	56.6 N	142.8 W	12	18	M 43	5 NM	52	0966.8	10.3	11.1					
CHESNUT HILL	WVFX	29	32.9 N	140.6 E	18	04	46	5 NM	21	1001.0	23.3	25.6	4	6.5	04	< 6	11.5
ORIENTAL EXECUTIVE	DSAN	29	35.0 N	143.4 E	21	02	M 41	2 NM	02	0997.0	22.0						
ORIENTAL EXECUTIVE	DSAN	30	34.9 N	142.5 E	00	03	M 42	5 NM	02	0999.0	22.0						
ARILD MAERSK	OXTH	30	35.6 N	146.9 E	03	36	50	.25 NM	62	0982.5	25.0	24.0	4	29.5			
MOBIL ARCTIC	KSPY	30	58.1 N	142.2 W	06	18	M 45	5 NM	50	0990.5	11.1	10.0	7	13	18	8	24.5
CHESNUT HILL	WVFX	30	34.2 N	142.1 E	06	36	43	5 NM	01	1003.4	22.8	25.0	5	6.5	36	6	10
SUNNY PIONEER	H3SY	30	37.9 N	147.0 E	12	05	M 46	1 NM	03	1001.9	17.8	20.0					
DVITROGNITAL HOVE		19	51.0 N	136.0 W	15	27	M 42			1002.2	13.4	13.1					
46004		28	51.0 N	136.0 W	11	16	M 43			989.0	12.4	13.2					
46004																	
		OCT.															
PACBARON	ABYI	1	49.5 N	166.8 E	00	14	M 43	200 YD	59	1010.0	8.0	11.0	XX	16.5	14	12	16.5
POLAR ALASKA	SLEU	1	49.2 N	158.8 E	00	05	M 45	200 YD	25	0998.3	8.0	8.0	5	8	05	< 6	8
PACBARON	ABYI	1	49.7 N	164.8 E	06	11	M 65	50 YD	65	0972.0	8.0	11.0	XX	26	14	12	49
EASTERN DIAMOND	HOOT	1	50.6 N	173.2 E	09	10	M 30	1 NM	63	1000.0	10.0		5	8	10	< 6	41
KOREAN FIR	ABWW	1	50.6 N	170.2 E	12	11	M 43	50 YD	54	0999.2	11.5	9.0					
KEYSTONE CANYON	KSFK	1	55.5 N	139.8 W	18	15	45	2 NM	00	0998.0	11.7	10.0	4	41	15	8	82
ARCO SAG RIVER	WLDF	1	54.5 N	143.7 W	18	26	45	5 NM	02	0999.8	12.2	11.2	4	10	19	7	19.5
SEALAND TRADE	WEUI	2	49.6 N	173.1 E	00	22	50	.5 NM	46	0965.0	13.4	13.4	3	10	24	9	23
KEYSTONE CANYON	KSFK	2	56.7 N	140.6 W	00	25	55	2 NM	01	1006.0	11.7	10.0	4	41	25	9	82
FRANCIS SINCERE NO 6	5MCN	2	50.9 N	179.5 W	00	14	M 35	2 NM	10	0983.0	7.5	9.0	6	32.5	14	6	29.5
KOREAN FIR	ABWN	2	49.9 N	169.1 E	00	38	M 45	.5 NM	53	0969.4	9.8	9.2	7	11.5	27	13	21
EASTERN DIAMOND	HOOT	2	49.5 N	172.5 E	03	31	M 55	1 NM	25	0976.5	11.0	9.5	9	65.5	31	9	65.5
ARCO SAG RIVER	WLDF	2	57.7 N	141.7 W	18	14	43	5 NM	15	1004.0	14.4	11.2	4	8	15	7	16.5
AMERICAN INDEPENDENCE	KLWV	3	29.5 N	152.5 E	00	18	M 43	2 NM	97	0998.0	29.0	26.5	XX	24.5	18	10	13
AMERICA MARU	JNXV	3	42.3 N	169.8 W	06	28	M 47	2 NM	16	0993.5	12.0	14.5	7	14.5	28	9	32.5
ATLANTIC PIONEER	H3WN	3	51.7 N	140.5 W	12	24	M 45	2 NM	03	1003.5	11.0	14.0					
PRESIDENT TYLER	WEZM	3	53.0 N	175.4 W	12	03	M 46	5 NM	41	0993.0	6.7	4.4	8	10	03	8	13

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C.		Sea Waves†		Swell Waves	
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.
NORTH PACIFIC OCEAN		OCT.															
ARNOLD MAERSK	OZGI	4	41.2 N	156.7 E	06	01	45	5 NM	80	1005.6	12.4	16.0	9	26			
CHUEN ON	H3GX	4	17.0 N	168.7 E	12	09	60	2 NM	62	0991.0	7.5	6.0					
PACIFIC VENTURE	HOVS	4	54.7 N	151.3 W	18	06	41	.5 NM	10	0983.9	10.0	14.0	6	19.5	06	8	24.5
ATLANTIC PIONEER	H3WN	4	53.6 N	151.0 W	18	08	45	2 NM	44	0999.2	11.0	11.0			05	7	11.5
FRIENDSHIP	ELXP	4	49.3 N	168.2 E	18	05	47	2 NM	63	0992.0	5.5	10.0	7	10	05	7	13
SINALOA	OXNS	4	46.0 N	164.9 E	18	36	51	5 NM	00	0989.5	6.2	14.0					
HOEGH MIRANDA	LIOZ	4	40.6 N	173.9 E	18	23	45	1 NM	10	0997.5	18.2		8	19.5			
HANJIN INCHEON	D8OC	4	44.3 N	165.1 E	21	05	57	.5 NM	21	0994.0	9.0	12.0	XX	23	36	13	29.5
SEATRAIN CHESAPEAKE	D5QC	4	37.4 N	135.4 W	23	23	55	10 NM	01	1008.0	21.0	18.0	8	8	23	7	8
FRIENDSHIP	ELXP	5	49.7 N	170.2 E	00	02	55	2 NM	63	0984.0	7.0	11.0	8	16.5	02	10	19.5
SINALOA	OXNS	5	45.9 N	165.9 E	00	34	44	2 NM	25	0994.0	7.4	13.9	7	16.5	05	8	16.5
LEO	5LHT	5	45.6 N	166.8 E	01	31	42	1 NM	97	0993.0	7.3	10.0	4	28	32	< 6	10
VIENNA WOODS	5LOT	5	49.5 N	178.1 W	05	12	50	.5 NM	82	0977.0	7.0	7.0	15	29.5	12	>13	31
SEALAND DEVELOPER	KHRH	5	44.0 N	170.3 W	06	15	42	5 NM	63	0998.0	12.3	11.0	3	14.5	01	6	10
ATLANTIC PIONEER	H3WN	5	53.7 N	155.6 W	06	21	46	1 NM	25	0999.2	10.9	11.0					
CHUEN ON	H3GX	5	47.2 N	171.2 E	06	36	55	200 YD	64	1009.1	6.0	7.0					
SUNNY PIONEER	H3SY	5	47.4 N	177.9 E	06	20	58	200 YD	07	0961.0	6.5	8.0	8	32.5	24	8	32.5
DAFFODIL	H3AG	5	50.7 N	178.6 E	12	05	45	1 NM	63	0975.0	8.0	11.0	3	11.5	05	>13	14.5
SUNNY PIONEER	H3SY	6	48.2 N	177.9 W	00	33	46	2 NM	03	0993.0	9.5	8.0	9	59	33	9	59
MELLON WHEC 717	NOIT	6	57.9 N	141.4 W	00	11	19	5 NM	02	0999.3	11.5	11.1	7	1.5	12	7	34.5
YAMASHIN MARU	JBES	6	37.6 N	142.8 W	03	32	21	10 NM	01	1012.0	19.0	20.0	4	6.5	30	12	32.5
VIENNA WOODS	5LOT	6	49.2 N	173.0 W	05	33	49	2 NM	03	0991.0	7.0	7.5	15	29.5	33	>13	31
MOEGH MINERVA	LIOL	6	42.5 N	155.5 W	18	27	22	5 NM	03	1005.0	15.0				27	7	32.5
SEALAND DEVELOPER	KHRH	6	43.2 N	151.7 W	18	26	44	5 NM	02	1000.1	16.5	15.0	3	13	27	7	19.5
SEALAND DEVELOPER	KHRH	7	42.7 N	148.6 W	00	26	45	10 NM	01	1007.0	17.5	15.0	3	14.5	27	7	19.5
TOYOTA MARU 12	JBJO	7	53.8 N	157.6 W	09	31	42	10 NM	01	0994.5	7.0	8.0	5	10	31	8	16.5
JAPAN RAINBOW	JPVJ	7	54.3 N	151.6 W	12	28	45	5 NM	02	0980.4	9.0	12.0	3	5	28	< 6	8
OVERSEAS NEW YORK	WMCK	7	48.1 N	151.9 W	12	29	47	5 NM	60	1008.5	10.0	11.1	4	10	23	>13	19.5
WESTERN HIGHWAY	3FTF	8	51.0 N	166.8 W	00	05	42	1 NM	63	0998.3	6.0	7.0	5	5	06	6	6.5
SHUNWIND	ELTQ	8	53.7 N	145.3 W	03	27	45	10 NM	01	1003.0	10.0	11.0	7	23	27	8	36
NEPTUNE DIAMOND	9VYT	8	53.3 N	141.7 W	06	27	43	5 NM	01	1008.5	9.7	17.0					
BELLMAN	9VUP	9	47.2 N	153.7 E	12	27	46	5 NM	01	1000.9	7.0	9.0	2	11.5	26	< 6	11.5
MOBIL ARCTIC	KSPY	10	59.4 N	144.7 W	00	12	48	5 NM	52	1000.0	8.9	8.9	7	8	12	8	13
MELLON WHEC 717	NOIT	10	57.2 N	137.2 W	06	13	42	5 NM	02	1003.0	11.2	11.1			14	6	10
OCTA	A8OG	10	51.6 N	170.2 E	06	24	44	10 NM	03	1000.3	8.0	9.0	9	28			
ARCO FAIRBANKS	WGWB	10	51.8 N	135.4 W	18	19	42	10 NM	07	0997.3	9.7	10.0	8	16.5	19	12	32.5
GREAT LAND	WFDP	11	53.8 N	135.6 W	00	17	41	5 NM	03	0995.6	16.5	12.8	4	3	20	< 6	6.5
OCTA	A8OG	11	51.2 N	169.2 E	00	24	43	10 NM	02	1004.5	8.4	8.0	9	26			
PRESIDENT PIERCE	WURV	11	53.4 N	173.0 E	06	23	25	10 NM	02	0999.3	8.3	5.6	4	13	25	8	32.5
AMERICAN RELIANCE	KNKX	11	53.9 N	162.3 E	12	29	25	> 25 NM	01	1003.7	7.2	9.0	6	8	29	< 6	32.5
LNG TAURUS	WDZW	11	21.1 N	131.2 E	18	17	42	10 NM	82	1010.8	27.0	25.6	8	10	18	>13	19.5
GOLDEN PHOENIX	3EYN	12	51.3 N	147.4 W	00	28	44	10 NM	03	0980.0	9.5	12.5	5	10	30	6	13
SEALAND PATRIOT	KHRF	12	27.5 N	128.5 E	12	14	42	5 NM	54	1003.0	28.0	26.0	3	1.5	18	8	24.5
GEORGE WYTHE	KIBK	12	26.5 N	122.7 E	18	34	50	2 NM	50	1003.7	22.3	25.0	2	24.5			
PACMERCHANT	5MCB	12	47.3 N	135.1 W	18	24	45	10 NM	21	0998.7	11.8	16.0	4	5	24	7	10
UNIVERSAL WING	8KXF	13	49.8 N	139.5 W	00	34	42	.25 NM	81	1006.0	11.0	12.0	4	23	33	8	13
GEORGE WYTHE	KIBK	13	24.7 N	122.5 E	00	32	45	10 NM	01	1009.3	24.4	26.7	7	32.5			
SEALAND PATRIOT	KHRF	13	26.2 N	122.9 E	06	31	46	10 NM	01	1017.4	26.0	24.0	3	24.5			
PACMERCHANT	5MCB	13	47.4 N	137.6 W	06	32	49	5 NM	02	1011.5	12.0	15.0			31	8	19.5
PRESIDENT KENNEDY	KCAK	14	32.9 N	126.5 E	00	33	48	10 NM	02	1010.6	17.8	20.0	3	13			
SEALAND FINANCE	WJKG	14	29.3 N	136.3 E	06	24	45	5 NM	02	1002.3	26.7	25.6	XX	13	26	13	24.5
SAMOA	OXTZ	14	36.0 N	146.1 E	06	25	44	2 NM	21	0998.2	24.7	20.5	8	16.5	20	8	14.5
AMERICAN LEGION	WZJC	14	28.9 N	131.9 E	06	29	48	5 NM	03	1005.1	25.0	27.8	8	6.5	29		19.5
FALSTRIA	GYBG	14	46.2 N	144.1 W	17	31	46	2 NM	20	0992.5	11.1		14	29.5			
MILLER FREEMAN	WTDH	15	59.3 N	150.4 W	00	05	48	200 YD	81	0993.4	9.3	9.6	XX	6.5	05	6	19.5
IKAN KERISI	9VKG	15	49.9 N	163.3 W	03	18	45	2 NM	62	0993.5	6.0						
OJI GLORIA	5LTW	15	50.6 N	167.5 E	06	10	47	2 NM	40	0991.0	3.0	5.0	5	1.5	10	>13	1.5
NEPTUNE CRYSTAL	9VNW	15	37.8 N	158.4 E	06	02	55	2 NM	63	1004.5	14.6	20.1	8	4.5	07	9	13
AMERICAN RELIANCE	KNKX	15	42.3 N	171.2 W	06	25	40	2 NM	02	0996.1	15.0	11.7	9	32.5			
SHUNWIND	ELTQ	15	49.6 N	165.3 E	06	36	60	2 NM	07	0978.5	9.5	7.0	7	19.5	36	7	26
HANJIN POHANG	D8DN	15	47.9 N	166.2 E	12	30	52	1 NM	02	0973.0	7.0	9.0			26	>13	26
SAMOA	OXTZ	15	36.8 N	155.0 E	12	03	48	2 NM	02	1013.0	16.4	21.5	7	19.5			
PERENNIAL ACE	HOMQ	15	50.4 N	172.5 W	21	15	57	1 NM	62	0978.0	7.0	8.0	XX	13	15	12	13
EASTERN WORLD	ELVA	15	50.2 N	169.4 W	23	15	47	2 NM	58	0998.2	6.0	8.0	7	13	14	12	26
PACIFIC ACE	H3YP	16	43.0 N	176.6 E	00	27	41	5 NM	02	1005.0	11.0	11.0	8	11.5	18	7	13
PERENNIAL ACE	HOMQ	16	50.5 N	171.2 W	00	17	45	1 NM	63	0974.2	8.5	8.5	7	13	17	10	16.5
BRINTON LYKES	WLAQ	16	44.3 N	176.0 E	00	28	48	5 NM	02	1000.0	11.0	6.7	2	23	27	8	26
IKAN KERISI	9VKG	16	50.0 N	161.9 W	06	28	45	2 NM	00	0998.7	7.0						
DISCOVERER 6SS	WTEA	16	54.5 N	165.1 W	12	10	44	5 NM	51	0969.5	6.5	7.9	5	6.5	17	7	10
PRESIDENT HOOVER	WTST	16	54.2 N	179.7 E	12	02	50	10 NM	01	0999.1	5.0	7.2	5	5	02	12	16.5
SEALAND MCLEAN	WHCA	16	51.3 N	159.8 W	12	14	50	.25 NM	55	0978.6	8.9	7.8	6	8	12	9	18
PACMERCHANT	5MCB	16	41.2 N	156.8 W	12	23	H 47	5 NM	00	1013.5	16.0	16.0	5	3	23	9	8
EASTERN WORLD	ELVA	16	49.9 N	162.2 W	23	23	H 35	10 NM	02	0997.4	9.0	9.0	4	13	23	8	32.5
OVERSEAS NEW YORK	WMCK	17	45.8 N	151.6 W	12	25	45	10 NM	18	1001.0	10.0	11.1	5	6.5	25	6	10
PERENNIAL ACE	HOMQ	17	50.0 N	153.5 W	18	24	H 43	2 NM	25	0987.0	9.0	10.0	4	6.5	25	8	32.5
SOUTH EXPRESS	A8WR	17	49.8 N	155.8 W	18	28	H 56	2 NM	66	0988.0	9.0	11.0	8	36	28	8	36
SOUTH EXPRESS	A8WR	18	49.4 N	156.3 W	00	25	H 55	2 NM	03	0993.0	9.0	11.0	10	42.5	25	>13	39
PACIFIC HIGHWAY	JLJL	18	54.4 N	165.3 W	00	31	H 44	2 NM	81	0980.5	7.0	8.0	6	10	31	9	16.5
PERENNIAL ACE	HOMQ	18	49.6 N	148.7 W	06	25	H 42	5 NM	25	1000.0	9.5	10.0	8	13	26	>13	21
PACIFIC ACE	H3YP	18	42.4 N	161.3 W	18	31	H 41	10 NM	80	1016.0	10.0	13.0	7	11.5	29	7	10
SKAUGRAN	LMUK	18	48.7 N	156.9 E	18	27	50	10 NM	02	1011.0	7.0						
SKAUGRAN	LMUK	19	48.2 N	155.7 E	00	27	45	10 NM	02	1017.5	7.5		4	5	28	10	16.5
SOUTH EXPRESS	A8WR	19	49.0 N	161.2 W	00	30	H 40	5 NM	00	1002.0	10.5	10.0	6	32.5	30	13	29.5
MELLON WHEC 717	NOIT	20	59.6 N	145.9 W	00	12	H 42	5 NM	07	1002.8	11.0	11.1	8	8	10	7	19.5
ALASKA STANDARD	WHDN	20	60.0 N	146.0 W	00	11	60	2 NM	02	1004.4	8.9	9.0	8	24.5	10	6	32.5
PACMERCHANT	5MCB	20	36.8 N	175.2 W	00	22	H 47	5 NM	62	1015.0	20.3	20.5	3	3	21	7	11.5
MILLER FREEMAN	WTDH	20	60.0 N	147.7 W	03	11	H 50	2 NM	18	1001.1	9.4	8.9	3	3	14	< 6	5
TALISMAN	LFEN	20	43.5 N	156.9 E	12	07	H 42	5 NM	60	1016.0	12.0						
SOUTH EXPRESS	A8WR	20	49.8 N	171.7 W	12	02	H 48	5 NM	60	0989.0	5.0	8.5					
MING GALAXY	BLHW	20	39.9 N	161.6 W	12	18	H 58	5 NM	07	1004.8	15.1	17.0					
PACIFIC ARROW	J8FM	21	42.2 N	155.1 W	00	19	H 43	1 NM	65	0989.5	15.0	13.3	10	10	18	12	19.5
SEALAND LIBERATOR	KHRP	21	49.6 N	152.8 W	00	16	H 48	2 NM	02	0998.3	13.0	10.0	7	32.5			
FRIENDSHIP	ELXP	21	52.7 N	162.8 W	06	01	H 55	2 NM	62	0975.5	6.0	10.5	9	18	02	11	24.5

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves* Period sec.	Sea Waves* Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		OCT.															
FRIENDSHIP	ELXP	21	52.6 N	165.4 W	12	34	M 45	2 NM	60	0985.0	4.0	10.0	8	16.5	34	10	21
NEPTUNE CRYSTAL	9VNW	21	41.5 N	141.7 W	12	16	M 47	5 NM	02	1015.5	17.2	15.9					
VIENNA WOODS	SLOT	21	53.3 N	150.5 W	17	13	M 54	1 NM	63	0987.0	10.0	8.0	12	24.5	13	>13	26
MOHSING BREEZE	3EOU	21	54.0 N	169.7 W	18	33	M 45	1 NM	03	0996.0	1.0	6.0	8	14.5	34	8	16.5
CHUEN ON	H3GX	21	54.4 N	152.8 W	18	12	M 45	1 NM	63	0982.5	14.5	8.0	6	11.5	11	8	19.5
MOHSING BREEZE	3EOU	22	53.9 N	171.2 W	00	33	M 46	2 NM	88	0998.7	2.0	6.0	8	14.5	33	8	19.5
GOLDEN PHOENIX	3EYN	22	51.1 N	141.0 W	00	14	M 41	2 NM	50	1005.0	11.0	14.0	4	10	13	< 6	11.5
NEWARK	WNDO	22	57.7 N	151.4 W	00	10	M 45	1 NM	63	0982.2	8.3	7.8	8	19.5	11	10	32.5
PACSTAR	6ZFW	22	41.6 N	145.1 E	06	29	M 43	5 NM	02	1004.0	10.0	18.0	6	8	27	8	11.5
ARILO MAERSK	OXTH	22	41.7 N	160.0 W	06	29	42	10 NM	89	1008.5	7.5	10.0	3	26	30	12	23
MELLON WMEC 717	NDIT	22	58.4 N	148.1 W	15	11	M 35	1 NM	53	0997.0	9.9	10.0			10	13	36
TONSINA	KJDG	22	56.9 N	141.7 W	18	13	45	5 NM	63	1002.7	8.9	8.3	3	10	14	8	24.5
TONSINA	KJDG	23	56.1 N	140.9 W	00	13	45	2 NM	63	1002.8	8.9	8.3	3	10	14	8	24.5
SOHIO INTREPID	KACK	23	53.7 N	137.6 W	06	14	45	2 NM	02	0999.0	12.2	11.1	2	19.5	14	< 6	28
OVERSEAS NEW YORK	WMCK	23	53.4 N	134.3 W	06	15	50	5 NM	15	1007.0	11.1	9.4	7	19.5	17	8	23
ARCO FAIRBANKS	WGWB	23	58.6 N	143.7 W	12	10	M 44	2 NM	60	0997.0	7.8	7.2	8	13	11	9	16.5
ARCO JUNEAU	KSRG	23	48.6 N	126.7 W	12	08	M 42	10 NM	01	1012.5	12.8	10.0	2	10			
SAMOA	OXTZ	23	48.1 N	135.1 W	18	17	M 42	10 NM	25	0993.6	15.2	14.5	9	13	15	9	16.5
NEPTUNE JADE	S6CT	23	52.0 N	137.8 W	18	12	M 46	4.5 NM	50	0985.5	13.5	11.0	8	5	10	>13	14.5
VAN TRIUMPH	6ZJP	23	50.8 N	134.5 W	18	13	M 50	5 NM	02	0996.0	14.0	14.0					
PORTLAND	WNDF	24	51.0 N	130.3 W	00	14	44	5 NM	02	1005.3	14.0	12.2	5	11.5	14	7	14.5
NEWARK	WNDO	24	53.9 N	138.0 W	00	13	M 45	2 NM	63	0984.1	11.1	8.9	8	16.5	14	9	23
TONSINA	KJDG	24	53.6 N	138.2 W	00	12	50	5 NM	61	0982.9	11.1	9.4	3	10	14	8	32.5
AMUR CAREER	3EXO	25	39.5 N	148.9 E	12	14	M 45	2 NM	50	1009.0	15.0	19.0	7	13	14	9	14.5
PACHERCHANT	5MCB	25	34.2 N	148.0 E	12	20	M 46	5 NM	02	1008.0	24.0	25.0	3	5	19	10	10
NEPTUNE DIAMOND	9VYT	25	25.0 N	120.7 E	18	04	M 41	10 NM	02	1014.0	21.0		5	3	05	6	5
SOUTH EXPRESS	A8WR	25	40.9 N	151.1 E	18	14	M 45	1 NM	63	1006.0	14.0	19.0	6	41	14	12	32.5
MARCONA EXPORTER	ELEC	26	33.8 N	143.9 E	06	27	45	5 NM	02	1003.3	25.0	25.0	9	24.5	27	9	18
PRESIDENT HOOVER	WTST	26	31.8 N	126.4 E	06	28	45	10 NM	02	1014.2	16.7	23.3	7	16.5			
EXXON PHILADELPHIA	WNFJ	26	48.5 N	132.2 W	06	23	M 45	10 NM	62	1001.0	10.2	15.0			33	7	8
TALISMAN	LFEN	26	47.9 N	148.7 W	06	16	M 41	2 NM	50	1000.0	11.0						
PACMERCHANT	5MCB	26	33.9 N	144.7 E	12	24	M 52	10 NM	02	1006.0	22.5	24.0	4	6.5	25	10	11.5
SOUTH EXPRESS	A8WR	26	37.7 N	147.3 E	18	24	M 45	2 NM	03	1000.0	19.0	20.0	8	42.5	24	>13	32.5
PACMERCHANT	5MCB	27	32.8 N	144.7 E	00	26	55	10 NM	02	1029.0	23.0	25.0	4	6.5	25	9	11.5
PERENNIAL ACE	HOMQ	27	53.8 N	153.1 W	03	36	M 44	5 NM	07	0988.0	6.0	9.0	6	13	34	6	11.5
SOUTH EXPRESS	A8WR	27	36.4 N	145.3 E	06	26	M 35	10 NM	03	1004.0	22.0	23.0	8	32.5	24	>13	32.5
GOLDEN GATE BRIDGE	JPZD	28	37.8 N	165.2 W	06	20	M 41	5 NM	03	1010.5	15.5	17.0					
BELLMAN	9VUP	29	41.2 N	150.6 W	06	16	M 42	1 NM	63	1008.0	13.5	14.0	3	10	16	9	13
SANTA ADELA	KWCS	29	15.3 N	94.2 W	18	34	45	10 NM	02	1011.2	30.0	26.1	6	8	34	6	10
SEALAND LIBERATOR	KHPP	30	35.1 N	144.6 E	00	02	M 50	2 NM	55	0991.5	22.3	25.0	3	13	02	>13	19.5
IRIS ISLAND	JPKG	30	47.8 N	175.7 W	00	29	M 49	.25 NM	45	0992.0	8.0	6.5	6	8	29	6	8
HOWELL LYKES	WLRP	30	12.4 N	96.0 W	06	07	45	5 NM	02	1010.8	27.2	28.9	3	10	07	7	14.5
PRESIDENT JEFFERSON	WPGE	30	50.0 N	141.5 W	06	08	50	5 NM	02	1000.3	11.1	10.6	3	5	11	6	8
EXXON PHILADELPHIA	WNFJ	31	55.0 N	138.2 W	00	09	M 45	1 NM	62	0999.1	11.8	8.9	6	10	08	9	26
SEALAND COMMERCE	WEUJ	31	35.4 N	143.7 E	06	23	45	10 NM	01	1002.5	17.7	19.5	6	10	23	10	13
SEALAND EXPLORER	WBJF	31	48.4 N	169.4 E	07	03	M 45	5 NM	63	1004.2	5.0	8.0	5	23	XX		23
PRESIDENT TYLER	WEZM	31	39.3 N	136.0 W	12	23	M 60	5 NM	65	0993.5	16.1	15.6					
WALTER RICE	KCSE	31	16.0 N	94.6 W	12	36	45	10 NM	07	1013.9	19.0	23.3	2	6.5	36	6	11.5
SUNNY PIONEER	H3SY	31	41.1 N	140.0 E	12	29	M 48	2 NM	64	1000.0	8.0	8.0	9	14.5	29	9	14.5
ENVIRONMENTAL BUOYS																	
46003		16	52.0 N	156.0 W	16	18	M 41			985.9	7.5	9.5					
46003		18	52.0 N	156.0 W	07	25	M 41			984.8	5.8	9.0					
46004		23	51.0 N	136.0 W	20	15	M 43			991.7	12.9	11.3					

+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 30 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

Continued from page 125.

SEPTEMBER DATA SUMMARY 44002
AVERAGE LATITUDE 40.1N AVERAGE LONGITUDE 073.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.5	(27 15)	20.5	23.9	(23 03)	235	30
SEA TEMP (DEG C)	18.5	(29 09)	21.0	23.2	(23 21)	235	30
AIR-SEA TEMP (DEG C)	-08.7	(27 15)	-00.4	02.0	(23 03)	235	30
PRESSURE (MBAR)	1005.0	(15 09)	1018.1	1026.2	(04 15)	235	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 01-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 234
N	.9	4.3	3.8		9.0	16.5	MAX WIND
NE	.9	5.6	4.7		9.0	18.6	SPEED: 23 KNOTS
E	1.3	3.8	10.3		15.4	18.9	DIRECTION: 330 DEG
SE		4.3	.9		5.1	9.0	DAY: 27
S	1.3	7.7	3.4		12.4	8.0	HOUR: 06
SW	.9	11.1	14.1		25.6	11.6	
W	.9	7.3	3.8		11.5	9.8	
NW	.9	6.4	3.8	.9	11.5	10.6	
CALM	.9				.9	.0	
TOTAL	5.6	48.7	49.9	.9	100.0	16.4	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 229

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	9.2	45.9	24.5	3.9	3.1	3.5			1.9M	7.5M	(26 06)

OCTOBER DATA SUMMARY 42004
AVERAGE LATITUDE 39.4N AVERAGE LONGITUDE 087.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
SEA TEMP (DEG C)	24.3	(31 00)	26.5	29.0	(02 16)	248	31
PRESSURE (MBAR)	1007.6	(01 00)	1021.8	1023.9	(31 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 01-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 248
N	1.2	17.7	19.0	.4	38.3	11.6	MAX WIND
NE	1.2	11.7	4.4		17.1	8.4	SPEED: 23 KNOTS
E	.4	5.5	2.4		11.1	9.2	DIRECTION: 020 DEG
SE		3.6	3.2		10.8	11.4	DAY: 29
S	.4	2.4	4.0		7.7	12.1	HOUR: 21
SW	.4	1.6	1.2		3.2	7.5	
W		1.6	2.4		4.0	11.3	
NW		1.6	4.0		8.5	10.7	
CALM	.4				.8	.0	
TOTAL	4.4	47.2	47.6	.8	100.0	10.5	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	35.1	54.4	10.5						1.1M	2.5M	(30 06)

OCTOBER DATA SUMMARY 44004
AVERAGE LATITUDE 39.0N AVERAGE LONGITUDE 070.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	10.7	(26 15)	17.8	24.9	(02 21)	230	30
SEA TEMP (DEG C)	19.0	(26 12)	22.4	27.6	(05 21)	231	30
AIR-SEA TEMP (DEG C)	-11.7	(29 21)	-05.1	00.6	(19 12)	230	30
PRESSURE (MBAR)	1001.2	(26 00)	1017.8	1029.6	(24 15)	230	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 01-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 230
N		.4	6.5	2.2	9.1	17.4	MAX WIND
NE		.4	1.7		2.2	13.6	SPEED: 44 KNOTS
E		1.7	.4	.9	.9	19.1	DIRECTION: 120 DEG
SE	.4			.9	1.3	27.7	DAY: 25
S	.9	3.0	7.8	3.0	.4	15.2	HOUR: 18
SW		2.6	11.7	3.9	.9	19.1	
W		5.2	10.7	7.0	.4	31.3	
NW	.4	2.6	11.3	3.0		17.4	
CALM	1.7					1.7	
TOTAL	1.7	16.1	58.7	28.0	3.5	100.0	17.2

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 229

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	9.2	45.9	24.5	3.9	3.1	3.5			1.9M	7.5M	(26 06)

OCTOBER DATA SUMMARY 44011
AVERAGE LATITUDE 34.4N AVERAGE LONGITUDE 120.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.4	(02 15)	14.4	19.2	(25 21)	193	25
SEA TEMP (DEG C)	12.5	(26 09)	14.9	18.2	(31 21)	193	25
AIR-SEA TEMP (DEG C)	-03.6	(22 15)	-00.5	03.5	(29 21)	193	25
PRESSURE (MBAR)	1010.2	(29 03)	1016.2	1024.4	(29 18)	193	25

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) 01-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 193
N	1.6	14.7	1.0		16.6	6.6	MAX WIND
NE	1.0	4.1			5.7	5.4	SPEED: 22 KNOTS
E	2.6	.5			3.1	2.2	DIRECTION: 300 DEG
SE	1.6				1.6	1.0	DAY: 15
S		.5			.5	5.0	HOUR: 03
SW	.5	.5			1.0	4.5	
W	.5	4.1	2.1		6.7	8.8	
NW	.5	23.2	39.4	.5	63.7	12.0	
CALM	1.6				1.6	.0	
TOTAL	9.8	47.2	42.5	.5	100.0	9.8	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 192

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	2.6	44.3	30.7	18.2	3.6			.5	2.0M	10.5M	(27 18)

U.S. Cooperative Ship Weather Reports

September and October 1980

This listing includes only those ships recruited in the U.S. Cooperative Ship Program whose Ship's Weather Observations (NOAA Form 72-1) were mailed to the National Climatic Center and/or the coded weather observations were transmitted to the appropriate radio station.

SHIP NAME	VIA RADIO	VIA MAIL
ACADIA	41	51
ADM W* M CALLAGHAN	36	74
AGUADILLA	101	139
ALBATROSS IV	98	
ALGENIB	33	62
ALSTER EXPRESS	70	80
AMERICA SUN	53	112
AMERICAN APOLLO	33	90
AMERICAN ARROW	3	
AMERICAN CHIEFTAIN	43	101
AMERICAN LANCER	61	118
AMERICAN LEGEND	26	85
AMERICAN RACER	29	108
AMERICANA	6	
ANCO TEMPLAR	47	
ANTONIA JOHNSON	18	52
ARCO CALIFORNIA	80	38
ARCO JUNEAU	63	91
ARECIBO	65	90
ARNOLD MAERSK	7	79
ASIA BRAVERY	22	100
ASIAN EXPRESS	11	
ATLANTIC PIONEER	11	88
AUSTRAL ENVOY	18	51
AUSTRAL MOON	35	132
AVILA	7	
B T SAN DIEGO	4	32
BARBER TAIF	5	
BASSWOOD WLB388	5	29
BEISHU MARU	76	14
BLUE BOTTLE	62	162
BOGASARI SATU	2	
BOUTWELL WHEC 719	27	32
BROOKS RANGE	15	7
C V LIGHTNING	23	47
CALIFORNIA RAINBOW	12	26
CANNIVALE	28	27
CHARLES LYKES	26	76
CHASE WHEC 714	3	
CHEROKEE WMEC 165	2	47
CHEVRON ARIZONA	23	62
CHEVRON COPENHAGEN	16	23
CHEVRON KENTUCKY	91	
CHEVRON NAGASSAKI		97
CHEVRON PERTH	42	70
CITRUS WLB300	24	
COLORADO	19	74
COMET	7	97
CONCORCIA SUN	4	
CORVIGLIA	2	
CRYSTAL REEC	11	10
DALAMAR	77	
DAVID PACKARD		63
DFL ORG	32	29
DELAWARE II	96	126
DELTA ARGENTINA	24	38
DELTA ECUADOR	26	77
DELTA PARAGUAY	17	4
DELTA VENEZUELA	21	36
DITTE SKOU	6	81
DOLLY TURMAN	27	8
DUBHE	12	
EASTERN CHERRY	25	
EASTERN PACIFIC	1	19
EASTERN WISEMAN	9	14
EL MEXICANO	2	
ENNA G	56	142
ESSO PHILIPPINES	40	114
EVER SPRING	23	29
EXPORT ADVENTURER	3	
EXPORT CHALLENGER	16	45
EXPORT LEADER	30	101
EXXON BATON ROUGE	49	108
EXXON HOUSTON	20	40
EXXON NORTH SLOPE	2	23
FAIRLOAD	1	
FFH MATARENGEI	1	
FRANCIS SINCERE NO 6	20	41
GALVESTON	1	
GEMINI TRADER	1	
GEORGE M KELLER	11	26
GLOBAL FRONTIER	32	85
GOLDEN GATE	12	16
GOLDENSARI II	38	107
GREAT CONCERT	1	
GREEN AUKLET	36	
GREEN HOBE	21	72
GULF BANKER	11	16
GULF TRADER	36	81
HAMILTON WHEC 715	1	56
HARUNA MARU	103	21
HILLIER BROWN	6	17
HOEGH MASCOT	17	119
HOEGH MIRANDA	16	78
HOEGH TRIGGER	11	
HOWARD G VESPER	2	28
HUMACAO	1	32
IRIS ISLAND	28	74
ITALICA	20	13
J LOUIS	51	50
JALAYAPINI	12	
JAPAN APOLLO	31	84
JEFF DAVIS	18	
KARINITA		112
KAUAI	39	80
KEYSTONER	44	139
KOREA GALAXY	1	
KOREAN PRIDE	18	31
LABRADOR CLIPPER	3	
LASH ATLANTICO	22	69
LAVAUX	1	
LEXA MAERSK	60	
LONG LINES	1	
LUIGI GRIMALDI	22	
MAMMOTH PIR	18	31
MANUKAI	47	120
MARCHEN	1	
MARCONA TRANSPORTER	21	84
MARIA U	8	31
MARITIME HARMONY	32	
MASON LYKES	26	83
MAUI	47	96
MAYO LYKES	18	
MEDNIA	57	92
ACONCAGUA	19	24
ADRIATIK	34	
ALASKA STANDARD	90	13
ALERT	1	
ALLTRANS EXPRESS	25	48
AMELIA TOPIC	19	87
AMERICAN ACE	27	115
AMERICAN ARCHER	67	106
AMERICAN CHALLENGER	19	95
AMERICAN HIGHWAY	13	
AMERICAN LEADER	32	129
AMERICAN LIBERTY	33	107
AMERICAN RELIANCE	2	61
ANCHORAGE	10	
ANNA MAERSK	19	25
ARCO ALASKA	56	85
ARCO FAIRBANKS	32	49
ARCO PRUDHOE BAY	53	72
ARIES	26	11
ASHLEY LYKES	18	41
ASIA INDUSTRY	5	
ATLANTIC COMET	1	
AUSTRAL ENSIGN	20	51
AUSTRAL GLEN	19	
AUSTRAL PIONEER	15	24
AZTECA	2	
BALTIMORE TRADER	10	63
BARBER TONSBERG	8	28
BAYAMON	3	121
BERGLOT	11	37
BLUEBIRD	66	
BORINGLEN	87	156
BRINTON LYKES	39	79
BUNGA MELAWIS	17	127
C.W. MITTC		19
CAPRICORN	8	6
CHANCELLORSVILLE	26	87
CHARLOTTE LYKES	33	128
CHAVEZ	1	
CHESNUT MILL	26	78
CHEVRON CALIFORNIA	86	128
CHEVRON FELUY	2	45
CHEVRON LOUISIANA	16	43
CHEVRON OREGON	30	87
CHEVRON WASHINGTON	32	
CIUDAD DE NEIVA	1	
COLUMBUS LOUISIANA	23	
CONALCO	5	
CORAL ARCADIA	24	
CRESSIDA	47	136
DA MOSTO	6	
DAVID D. IRWIN	20	24
DAVIDSON	6	7
DEL SOL	6	28
DELTA AFRICA	8	74
DELTA CARIBE	9	24
DELTA MEXICO	24	62
DELTA SUD	3	46
DIANA	30	
DOCEANGRA	1	23
DRUCILLA U	33	58
DYKI PACIFIC	3	22
EASTERN FORTUNE	8	
EASTERN SUN	3	
EDELWEISS	3	
EL PASO HOWARD BOYD	1	
ESSO BANGKOK	23	48
EUGENIO C.	5	
EVERGREEN WASC-295	25	26
EXPORT BANNER	18	54
EXPORT COMMERCE	10	84
EXXON BALTIMORE	29	65
EXXON CHESTER	6	16
EXXON JAMESTOWN	13	22
EXXON SAN FRANCISCO	15	77
FALSTRIA	43	107
FLEETBANK	4	
FRIENDSHIP	22	83
GARTHNEWOOD	19	
GENISTA	4	9
GIBRALTAR PANSY	2	
GLOMAR CHALLENGER	72	83
GOLDEN RAY	11	
GRAND FELICITY	6	13
GREAT OCEAN	19	
GREEN HARBOLR	19	24
GRETE MAERSK	1	
GULF MERCHANT	6	
H J HAYNES		59
HANJIN POHANG		44
HELLESPONT GLORY	24	
HOEGH HALLARD	4	14
HOEGH MERIT	6	22
HOEGH ORRIS	5	
HONSHU GLORIA	53	36
HOWELL LYKES	47	66
INACHUS STAR	32	84
IRONWOOD WLB 297	22	
IVAN TOPIC	1	
JACKSONVILLE	29	101
JAPAN ACE	105	49
JAPAN RAINBOW	11	84
JOSEPH LYKES	17	115
KATHLEEN	6	13
KENAI	2	28
KOFUKU MARU	31	44
KOREAN PIR	15	21
KURUSE MARU	55	29
LAKE PALOURDE	24	48
LASH PACIFICO	10	52
LESLIE LYKES	23	43
LIONS GATE BRIDGE	101	108
LOUISE	59	126
MADALENA	52	
MANISTEE	26	
MANLLEI	51	102
MARCONA EXPORTER	15	107
MARGARET JOHNSON	31	25
MARINE COAST RADIO STN	2	
MARITIME DUFEN	11	55
MATINA	8	
MAYAGUEZ	37	78
MELLON WHEC 717		82
MILLER FREEMAN	73	98
ADABELLE LYKES	3	68
AFRICAN DAWN	22	16
ALASKAN	50	96
ALEUTIAN DEVELOPER	12	16
ALMERIA LYKES	26	94
AMERICA MARU	94	48
AMERICAN ALLIANCE	17	93
AMERICAN ARGOSY	45	85
AMERICAN CHARGER	33	78
AMERICAN INDEPENDENCE	22	130
AMERICAN LEGACY	29	95
AMERICAN LYNX	24	148
AMERICAN TRADER	36	171
ANCO STANE	69	
ANNIE JOHNSON	14	59
ARCO ANCHORAGE	35	28
ARCO HERITAGE	32	7
ARCO SAG RIVER	36	88
ARILD MAERSK	16	70
ASIA BEAUTY	13	18
ASIAN ASSURANCE	3	96
ATLANTIC OCEAN	1	
AUSTRAL ENTENTE	1	32
AUSTRAL LIGHTNING	49	108
AUSTRAL RAINBOW	85	47
B T ALASKA	2	15
BARBER PRIAM	32	63
BARRANCA	66	126
BAYANO	67	
BLESS RIVER	18	84
BOGASARI DUA	3	
BOSTON	14	40
BRITANIS	2	
BUTTONBOOC WLB 304	22	
CAGLAS		1
CARIBBEAN ENDEAVOUR	1	
CHAPMAN	14	
CHARLOTTE MAERSK		10
CHEPICAL VENTURE	7	
CHEVRON ANTWERP	9	51
CHEVRON COLORADO	59	93
CHEVRON FRANKFURT	4	21
CHEVRON MISSISSIPPI	59	119
CHEVRON PERNIS	37	123
CHUEN ON	25	148
CLOVER	32	100
COLUMBUS NEW ZEALAND	44	115
CONCORCIA STAR	20	
CORALCOPIA	31	27
CRISTOBAL	37	78
DAFFODIL	3	80
DAVID P REYNOLDS	100	171
DEFIANCE	5	10
DELAWARE GETTY	44	118
DELTA AMERICA	14	61
DELTA COLUMBIA	3	
DELTA PANAMA	5	11
DELTA URUGUAY	13	42
DISCOVERER OSS	139	161
DOCTOR LYKES	35	132
DUANE	12	
E. HORNSBY WASSON	39	57
EASTERN MUSE	49	
EASTERN TREASURE	71	103
EDGAR M QUEENY	18	40
ELIZABETH LYKES	72	140
ESSO BAYONNE	31	103
ELRC-ASIA CONCORDE	13	46
EYFORC	1	
EXPORT BLYER	35	77
EXPORT FREEDOM	17	64
EXXON BANGOR	16	33
EXXON FLORENCE	1	
EXXON NEW ORLEANS	17	29
EXXON WASHINGTON	7	9
FESTIVALE	8	
FRANCE MARU	20	13
GAGE LLAC	33	
GEMINI	1	
GEORGE B KELEZ	6	
GLACIER BAY	9	46
GOLDEN CAISY	25	16
GOLDEN ROC	10	
GRAND GLOBE	12	
GREAT REPUBLIC	8	
GREEN ISLAND	43	121
GUAYAPA	1	
GULF SHIPPER	39	112
HADJI ABLS SALIM	2	5
HARCANGER	46	
HIEI MARU	80	69
HOEGH MARLIN	17	
HOEGH MINERVA	1	42
HOEGH PILOT	5	22
HOTAKA MARU	56	8
HUDSON 1-AC 184	11	
INGER	13	21
ISLAS GALAPAGOS	1	
J E BOSLINE	7	
JADRAN	2	
JAPAN APBROSE	43	29
JEAN LYKES	2	
JUTHLANCIA	4	44
KATHY	1	
KENNETH E HILL	21	109
KOPAS	79	175
KOREAN LEADER	1	8
L.W. FLANKOLIER	53	186
LAKE SHASTA	9	10
LAUREL WLB29C1	9	
LETITIA LYKES	13	
LLOYD CLIABA	1	
LOUISE LYKES	35	
MALLORY LYKES	1	66
MANLANILI	48	37
MANZANARES	2	
MARCONA TRADER	16	80
MARGARET LYKES	18	4
MARITIME BRILLIANCE	3	6
MARJORIE LYKES	1	23
MATSONIA	46	133
MAYAYAN REEFER		7
MENESTHEUS	35	25
MILROSS	3	

TOTAL WEATHER REPORTS RECEIVED FROM US COOPERATIVE OBSERVING SHIPS SEPTEMBER AND OCTOBER 1980

SHIP NAME	VIA RADIO	VIA MAIL
PINERVA	5	
MOBIL AERO	6	106
MOBILE MERIDIAN	9	
MONYOUTH	11	35
MORMACARGO	12	31
MORMACLYNX	25	
MORMACSEA	6	55
MORNING GLORY		1
MUNRO WMEC 724	74	79
NEPTUNE AMBER	95	61
NEW GOLDEN PHOENIX	54	127
NEWCASTLE CLIPPER	12	
NORDANGER	2	
NORTHERN LIGHT	19	33
OCEAN CROWN	9	
OCTA	26	97
OJI GLORIA	22	74
ORANGE	13	
ORE NEPTUNE	1	
ORIENTAL EXECUTIVE	18	109
ORIENTAL SOVEREIGN	26	20
OVERSEAS ALEUTIAN	10	20
OVERSEAS HARRIET	7	
OVERSEAS VALDEZ		37
PACHUCHSS	11	6
PACIFIC ACE	12	58
PACIFIC SAGA	60	18
PACMAJESTY	3	10
PACPRINCE	19	23
PAN PACIFIC	1	
PENNMAR	10	
PERSIAN REEFER	3	9
PIONEER COMMANDER	6	
PIONEER MOON	76	142
PORTLAND	70	113
PRESIDENT GRANT	41	134
PRESIDENT JEFFERSON	84	158
PRESIDENT MC KINLEY	55	84
PRESIDENT TAYLOR	14	3
PRESIDENT WILSON	29	12
PUERTO RICO	1	
QUINTINA	40	
RALPH B JOHNSON	23	102
RELIANCE WMEC 615		100
REVERE	58	122
ROBERT E LEE	14	10
ROYAL VIKING SEA	15	
S P LEE	27	
SAMOA	54	107
SANKOSTEEL	23	34
SANTA MAGDALENA	17	42
SARGODHA	10	2
SEALAND CONSUMER	16	
SEALAND FINANCE	51	75
SEALAND MARKET	48	121
SEALAND RESCUPCE	50	143
SEATRAIN INDEPENDENCE	78	126
SEATRAIN TRENTON	72	161
SEDGE WLB WCZ	16	
SEVEN OCEAN	16	
SHERMAN WMEC 720	20	9
SILAS BENT T-AGS 26	20	27
SIMA	27	105
SKAUGRAN	48	101
SNOWDRIFT	1	
SOLON TURMAN	23	87
SPERO	6	
STAR DIEPPE	33	
STELLA LYKES	5	
STREAM HAWSER	10	12
SUSQUEHANNA		6
T F L LIBERTY		61
TAIKO VENTURE	9	
TASSO	90	171
TEXAS	18	
THOMAS G THOMPSON	20	82
THOMPSON PASS	23	
TONEI TOPIC	8	96
TOYOTA MARU 12	174	144
TRIUMPH	26	17
TUNISIAN REEFER	31	
UNIQUE FORTUNE	8	
UNIVERSE RUPE	15	49
VAN WARRIOR	49	149
VIENNA WOODS	33	86
WALCHAND	10	
WESER EXPRESS	21	61
WESTWIND WAGB 281	15	
WINTER STAR	22	81
WORLD PROSPECT	1	
YOUNG SCOPE	14	47
ZIM MONTREAL	21	77
ARIJ		56
CACE		36
DZEO	1	30
DSBL		59
DSSF	15	31
DSCR		66
ELIJ	10	32
ELYF	13	17
H3SY	3	101
H9AS	7	17
JJTY	50	57
JPVI	23	37
KDCA		147
KHRP	19	111
KSFJ	30	93
LFEL	14	29
LRQN	19	18
NGST	2	49
PPJT		24
SLKA		30
WGJF	47	122
WXKF		28
WZL8190		1
SLUB	19	59
3MYK	70	118
6ZRT	37	118
9MYP	52	109
9VWD	12	112
MING SPRING	4	
MOBIL ARCTIC	47	89
MOBILFUEL	3	6
MONTERREY	1	9
MORMACDAWN	28	64
MORMACMOON	6	
MORMACSUN	65	74
MOUNT EXPLORER	1	
NAGARA	24	41
NEPTUNE CRYSTAL	61	121
NEW JERSEY MARU	57	79
NORAWAY	39	50
NORDIC LOUISIANA	40	
NORTHERN VICTORY	21	15
OCEAN DUKE	1	
OGDEN FRASER	25	73
OLEANDER	112	1
ORE JUPITER	11	
ORIENTAL CHAMPION	28	19
ORIENTAL EXPORTER	26	30
ORIENTAL STATESMAN	17	45
OVERSEAS ANCHORAGE	1	
OVERSEAS JUNEAU	45	
OVERSEAS VIVIAN	21	54
PACDUKE	17	
PACIFIC ARROW	126	63
PACIFIC TRADER	85	
PACMERCHANT	20	31
PACPRINCESS	24	
PAN WESTERN	37	33
PEREIRA D'ECA	15	
PHILADELPHIA	56	102
PIONEER CONTENDER	15	26
PIONEER NO 1	33	16
PRESIDENT ADAMS	35	107
PRESIDENT HARRISON	14	32
PRESIDENT JOHNSON	86	169
PRESIDENT PIERCE	74	152
PRESIDENT TRUMAN	52	71
PRINCE OF TOKYO	30	46
PUNTA MALVINAS	14	37
QUIXADA	4	5
REO ARROW	42	40
RESEARCHER	78	110
RHEINFELS	9	
RODRIGUES CABRILHO	21	
ROYAL VIKING STAR	39	44
SACRAMENTO	1	44
SAMUEL S	36	34
SANKOSUN	5	
SANTA MARIA	2	
SCILLA	35	65
SEALAND DEVELOPER	29	109
SEALAND GALLOWAY	45	142
SEALAND MCLEAN	48	73
SEALAND TRADE	51	132
SEATRAIN LEXINGTON	65	117
SEATRAIN YORKTOWN	34	165
SEKI POKARO	1	1
SHANGRI LA	24	7
SHIRLEY LYKES	44	33
SILVER PHOENIX	26	44
SINALOA	33	77
SKYWARD	10	11
SNOWLAND	5	13
SONG OF NORWAY	6	
SPRAY DERRICK	13	16
STAR DOVER	25	55
STOLT LLANDAFF		52
SUCCESSFUL VENTURE	13	
SVENDBORG MAERSK	22	15
TAEPING	1	
TALISMAN	15	39
TAURUS	21	62
TEXAS TRADER	9	66
THOMAS MAERSK	8	48
TILLIE LYKES	30	82
TONSINA	33	123
TOYOTA MARU 93	57	35
TROPICANA	11	
TWIN JOY	7	
UNITED SEA ANGEL	7	
VALLEY FORGE	30	29
VELMA LYKES	42	103
VILLANGER	5	19
WALTER RICE	41	126
WESTERN HIGHWAY	76	79
WHITING	37	
WORLD CANDOUR	52	64
YAMASHIN MARU	102	101
YOUNG SEAGULL	11	20
ZOELLA LYKES	22	16
8LMH	12	19
8MCD	17	40
9ZOS	7	7
9ZQS	12	28
9ZWS		2
A8SW		2
C6CH	20	165
C6LQA	34	54
C6LQC		12
C6LYP		1
H3YH		
JCUF	64	28
JMBY	10	15
JMZP	28	29
KGJP	39	85
KNCX	4	20
KSFM	19	27
LFMM	15	100
NIMS	32	104
PJYA		74
SDPY	35	88
WCKD		38
WNCW		47
WYAN674		46
ZCKV		48
9MXF		3
9VKG		131
MING STAR	8	24
MOBIL LUBE	38	94
MOBILGAS	6	
MORANT	41	
MORMACRACO	39	92
MORMACRIDEL	18	34
MORMACVEGA	10	48
MOZART FESTIVAL	30	
NANCY LYKES	36	
NEPTUNE DIAMOND	77	130
NEW YORK MARU	25	36
NOPAL SEL	12	14
NORSE PILOT	26	35
NORTHWIND WAGB 282	36	65
OCEAN LOG	40	58
OGDEN THAMES	3	69
OLGA MAERSK	1	
ORE MERCURY	2	
ORIENTAL COMMANDER	16	
ORIENTAL LEADER	14	121
ORIENTAL TAIO		47
OVERSEAS ARCTIC	19	46
OVERSEAS NATALIE		5
PACBARON	17	10
PACEMPEROR	13	
PACIFIC ERA	57	56
PACIFIC VENTURE	76	132
PACMONARCH	3	
PACSTAR	22	38
PARALLA	13	55
PERENNIAL ACE	104	366
PHILIPPINE CORREGIDOR	8	38
PIONEER CONTRACTOR	24	78
POLAR ALASKA	10	174
PRESIDENT CLEVELAND	29	14
PRESIDENT HOOVER	71	78
PRESIDENT KENNEDY	66	137
PRESIDENT POLK	8	15
PRESIDENT TYLER	54	127
PRINCE WILLIAM SOUND	14	71
PURE OIL	13	105
R G FOLLIS		52
RED JACKET	1	15
RESOLUTE	30	101
RICHARD	36	74
ROSE	2	120
RUSH WMEC 723		42
SALVADOR	16	41
SAN MARCOS	15	
SANSINENA II	19	50
SANTA MARIANA	30	82
SEA FAN	7	
SEALAND ECONOMY	25	84
SEALAND INDEPENDENCE	44	95
SEALAND PIONEER	33	99
SEALAND VENTURE	23	27
SEATRAIN ORISKANY	38	142
SEATRAIN TEXAS	17	
SEPTA	5	
SHELDON LYKES	2	
SHUNSANG	46	108
SILVER STAR	10	1
SINCERE NO 7	21	
SNOW CRYSTAL	2	
SOCONY VACUUM	10	61
SOUTHWARD	10	16
SPRINGBANK	1	
STAR HONGKONG	35	
STONEWALL JACKSON	11	100
SUGAR ISLANDER	39	96
SWEETBRIER WLB WCS	25	
TAI HSING	28	
TALISA T-AO-62		86
TEXACO MISSISSIPPI	4	13
TFL DEMOCRACY	20	91
THOMAS NELSON	17	
TOKYO RAINBOW	12	
TOSCA	1	
TRANSCOLORADO	24	97
TSU	29	49
TYSON LYKES	22	115
UNITED SPIRIT	19	104
VAN CONQUEROR	13	
VERRAZANO BRIDGE	4	7
VIOLET	13	
WASHINGTON TRADER	16	37
WESTERN SUN		15
WILLIAM E ALLSPAN	42	72
WORLD PELAGIC	1	
YOCONA WMEC 168	16	3
YUKON T-AO 152	50	131
2PAT		1
8MDR	21	40
8VEL	10	55
9ZDR	1	2
DSNZ	4	20
DSXA	10	90
ELCJ	4	9
ELUU	35	37
H8FW	10	48
H8LP	5	51
JHAC	17	31
JKMS	58	22
JOIK		14
KGJO	27	95
KPH2		87
KSLB	12	74
LIWM	7	51
NIRS		31
PJYA	1	61
SDPY	16	75
WCKD		23
WNCW		28
WYAN674		7
ZCKV	14	30
9MXF	11	16
9VKG	17	77
4ZDO	101	78
9VKG	7	19
PING YOUNG	1	
MOBIL POWER	29	49
MOBILOIL	4	32
MORMACALTAIR	19	76
MORMACGLEN	7	19
MORMACSAGA	18	
MORMACWAVE	20	
MT MITCHELL		32
NECHES	26	44
NEPTUNE JADE	38	74
NEWARK	63	162
NOPAL VERDE	3	6
NORTH STAR III	72	44
NORWAY	68	
OCEANIC	120	172
OGDEN WILLAMETTE	11	51
OLGA TOPIC	2	52
ORE MERIDIAN	13	100
ORIENTAL ESEARCHER	16	7
ORIENTAL MERCHANT	58	128
OTTO N. MILLER	27	177
OVERSEAS CHICAGO	7	14
OVERSEAS NEW YORK	28	111
PACBARONESS	14	22
PACGLORY	5	29
PACIFIC PEACE	11	110
PACLADY	22	9
PACNOBLE	16	25
PAN ASIA	10	28
PEIRCE	1	
PERRYVILLE	5	
PINK SKY	4	
PIONEER CRUSADER	17	24
POLAR SEA	143	182
PRESIDENT FILLMORE	41	103
PRESIDENT JACKSON	36	86
PRESIDENT MADISON	53	113
PRESIDENT TAFT	46	132
PRESIDENT VAN BUREN	27	103
PROSPERITY	7	
QUEENS WAY BRIDGE	95	56
RAINIER	1	
REGINA CELI	2	
RESOLUTE WPC 620	62	44
RIGOLETTO	7	
ROSE CITY	3	20
RUTH LYKES	26	
SAM HOUSTON	11	
SANKOSTAR	12	
SANTA BARBARA	10	
SANTA MERCEDES	15	32
SEALAND COMMERCE	57	104
SEALAND EXCHANGE	73	144
SEALAND LEADER	13	101
SEALAND PRODUCER	14	
SEASPEED ASIA	4	27
SEATRAIN TEXAS	25	47
SEAWAY EISPATCH	26	
SERAFIA TOPIC	1	
SHENANDOAH	1	
SIENA	47	41
SILVERPLANA	20	45
SINCERE NO 5	23	
SNOW STORM	11	64
SONIC INTREPID	36	104
SOUTHWEST CAPE	21	
STACT BREMEN	33	
STARWARE	2	
STORIS WAGB 20	12	
SURVEYOR	86	65
T F L INDEPENDENCE	3	
TAI TUNG	20	15
TAMPA	5	
TEXACO NEW JERSEY	1	
TFL FREEDOM		10
THOMPSON LYKES	1	52
TONAMI MARU	58	15
TOWNSEND CROMWELL	110	147
TRANSCOLUMBIA	10	68
TUBUL	33	43
UNION CONCORD	3	
UNIVERSE	12	
VAN TRIUMPH	48	106
VICENTE GUERRERO	7	
VIRGINIA STAR	4	
WASHINGTON MODC	7	105
WESTWARE VENTURE	83	122
WILMINGTON GETTY	22	44
WORLD PRIDE	6	
YOUNG AMERICA	6	14
ZIM HONGKONG	2	
ATPO	13	35
CSDR	7	16
DXRL		15
DZNR	7	19
DSGC	54	112
DSTF	10	101
ELFY		8
ELRT	23	60
HPET	30	54
HSRC	65	29
JJEB	81	35
JLJL	21	80
JREG	16	124
KHDF	57	124
KPHL	18	20
LEYH	4	9
LRQB	8	7
NMBA		242
PPSC	1	45
S6FA	23	31
WCZR	5	29
WSRV		5
WYQ5906		10
3FM5		26
5PWE	24	120
6ZNT	22	44
9GVP		34
9VPV		45

SUMMARY: GRAND TOTAL VIA RADIO 22458 GRAND TOTAL VIA MAIL 46972

Rough Log, North Atlantic Weather

December 1980 and January 1981

ROUGH LOG, DECEMBER 1980--The storms favored the area within 600 mi of the East Coast then northeastward toward Iceland. The tracks became more diffuse over the central ocean as the storms approached northern Europe. There were several strong storms over the Mediterranean Sea. The usual primary path over the Great Lakes could only be considered secondary, and the climatic track into Baffin Bay was not present.

There were major differences in the mean sea-level pressure and climatology. The Icelandic Low had two centers, the primary one was 993 mb west of Bodo, Norway. The other center was 998 mb near Keflavik. Climatology indicates two centers with the deeper one near 62°N, 30°W, and the second center near 68°N and Greenwich. The Azores High was 1030 mb near 40°N, 18°W, verses 1021 mb over the long term and 500 mi to the southwest. The more intense pressure centers produced a tighter gradient which indicates stronger storms than usual.

The strongest anomaly over the primary shipping lanes was plus 12 mb near Cape Finisterre. This large area dominated the area between 20°N and 60°N and Europe to 50°W. The largest negative anomaly was over the Barents Sea east of Murmansk.

There was an upper air LOW over Baffin Island to match climatology, but the lowest height center was north of Nordkapp. The climatic averages do not indicate this circulation. The upper air High was many miles northeast of its usual position and more intense. A trough paralleled the East Coast. In general, the flow was from the southwest over the primary shipping lanes.

Extratropical Cyclones--The eastern slopes of the Rocky Mountains produced this storm. On the 2d the storm was passing over the Great Lakes. There were gale and storm warnings posted for most of the lakes. There were also lake-shore flood and erosion warnings for the south shores of Lakes Erie and Ontario. Northerly winds gusting above 50 mi/h were howling off the Lakes. Gale warnings were still posted on the 3d with Chesapeake and Delaware Bays added. Storm warnings were issued for the Atlantic coast. On the 3d the storm was centered over New England. A report from a Canadian vessel north of Sable Island at 0000 of the 4th indicated 55-kn southeasterly winds and 25-ft seas. At 1800 three ships including the NANT reported 50- to 60-kn winds and waves to 31 ft off the Virginia to New Jersey coast. On the 5th the storm had two centers. At 0000 on the 6th the LOW was 986 mb near 44°N, 58°W. Between 1200 on the 5th and 0000 on the 6th (fig. 46) there were three extreme wind reports: STRATHEDEN (41°N, 62°W), 74 kn; ST LAWRENCE NAVIGATOR (49°N, 68°W), 72 kn; and the EASTERN SNELL (49°N, 64°W), 88 kn.

The storm's gradient loosened on the 6th, and another center formed in the trough to the south. This center moved in a more easterly direction. Late on the 8th the AMERICAN ACCORD (47°N, 28°W) found 45-kn gales and 23-ft seas. The BORGNES found 53-kn winds and 26-ft waves on the 9th near 46°N, 23°W. The

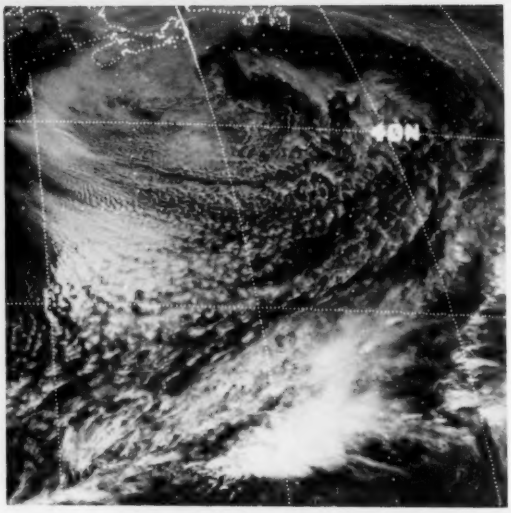


Figure 46.--The view from 22,000 mi shows the storm near Sable Island.

eastern edge of the storm was affecting the North Sea, where several observers found winds near 50 kn. The storm died on the 11th southwest of Iceland.

This storm came out of Quebec north of Sept-Iles. At 1200 on the 12th the storm was centered midway between Kap Farvel and Trinity Bay. Three platforms near 47°N, 50°W, had 50-kn winds. The ANTON DOHRN near Kap Farvel found 48 kn and 20-ft seas. This storm was overtaking another, which was absorbed on the 13th. The gradient was tightening and at 1800 OWS Lima had 45-kn winds. At 0000 on the 14th OWS Charlie was fighting 52-kn winds and 26-ft waves. By 0600 the waves were 30 ft. The AMERICAN ALLIANCE (51°N, 25°W) found 45-kn winds.

On the 14th the storm split into two centers with the eastern one surviving. At 1800 the AMERICAN ALLIANCE reported 50-kn winds and 33-ft swells. The WIDAR near 51°N, 20°W, had winds of 60 kn and 30-ft waves. Meantime, yet another LOW had formed over Scotland and was bringing winds up to 65 kn and waves up to 36 ft to the North Sea on the 15th (fig. 47). The second LOW died out as the third one continued as a strong storm over Scandinavia.

The area north of Montreal produced this LOW. It moved south of a LOW that was over the Labrador Sea on the 15th. The DART CANADA was south of Cape Race on the 16th with 57-kn winds and 23-ft waves. Several other ships had winds near 50 kn. Charlie had swell waves up to 33 ft. By 0000 on the 17th the storm had consolidated with two other LOWs and was 960 mb west of Keflavik. At this time the SEPIA was south of the city with 60-kn winds and 28-ft swells,

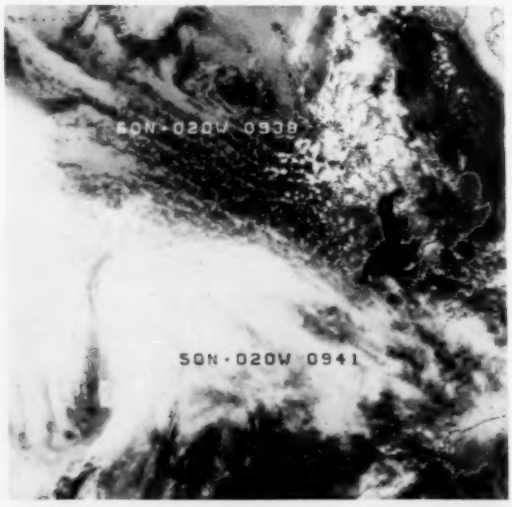
Figure 47.--The cloud streaks over the Norwegian Sea are indicative of the high winds and instability.

while Charlie had 36 ft and Lima 28 ft. At 1200 the FEDERAL HUDSON (60°N, 23°W) reported 46-ft waves. The English ship GTOT reported 39-ft swells. A ship with the call letters 9VUR was in the North Sea and reported winds of 74 and 72 kn on two consecutive observations and then 64 kn. Lima was still having 33-ft swells into the 18th (fig. 48). The storm was approaching Nordkapp on the 19th and weakening.

There was a complicated low-pressure system off the U.S. East Coast on the 16th. One of several LOWs was off Cape May. It traveled northeastward and developed an elongated circulation off the coast. Waves formed on the front and tended to keep the windspeed down. At 1200 on the 18th the 976-mb storm was 300 mi south of Kap Farvel. A ship in the warm sector near 48°N, 38°W, had 33-ft swells. By 0000 on the 19th, the storm was 966 mb. Charlie was about 300 mi to the south and measured 50-kn winds, 26-ft seas, and 33-ft swells. The front was slightly west of Lima with 45-kn winds. The MONSOON was north of Romeo and both had waves of 20 ft. At 1200 the storm was at 59°N, 19°W. The AMERICAN ACCORD (46°N, 31°W) was 900 mi southwest of the center, south of the front, with 48-kn winds and seas of 41 ft. The CARCHESTER (46°N, 35°W) only a few miles away reported 45-kn winds with 39-ft waves. The storm was about 100 mi north of Lima, who had 30-ft swells. Two ships had 60-kn winds. On the 20th the C.P. DISCOVERER (52°N, 21°W) had 57-kn winds with 20-ft waves. Ships reported waves up to 30 ft south of Ireland. On the 21st the storm was over Denmark and loosing its potential.

This innocuous little cyclone was first found over the St. Lawrence River on the 19th. It was 972 mb 24 hr later over the Labrador Sea. Two ships were hit by 45-kn winds. By 0000 on the 21st the storm had raced to 60°N, 33°W. Kap Farvel measured 40-kn winds, while Charlie had 45 kn and 21-ft seas. The SEPIA (54°N, 41°W) reported 68-kn winds with 30-ft seas and 39-ft swells.

The storm suddenly slowed its forward plunge between 0000 and 1200. At 0600 the wind report from the SEPIA read 136 kn, but this was probably an encoding problem and should have been 70 kn. The



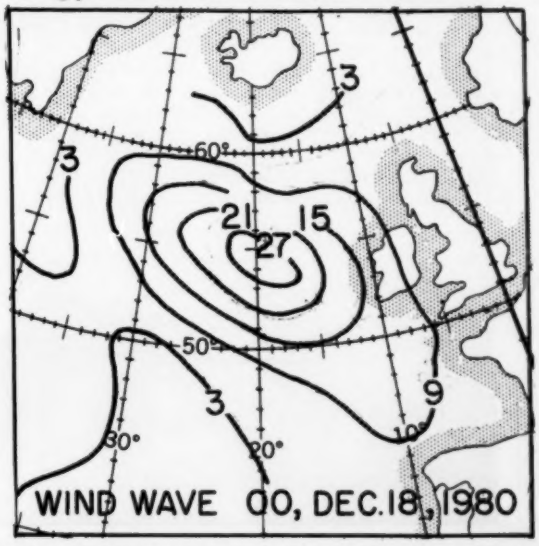


Figure 48.--This sea-wave analysis for 0000 and satellite image for 0940 on the 18th show the same area and relation of the high-wave area to the cloud system.

swell waves converted to 61 ft. This would probably have been considered transmission or coding also, but at 1200 the FEDERAL HUDSON (56°N, 40°W) reported 56-ft seas and swells. At this time the SEPIA reported 81 kn, 23-ft seas, and 39-ft swells. The LINDA DAN (59°N, 44°W) had 52-kn winds and 36-ft waves. On the 22d the SEPIA's winds and waves had decreased to 60 kn and 23 ft.

The storm stalled near the west coast of Iceland on the 22d until dissipating on the 23d. Strong gales and waves up to 20 ft continued as other low centers continued to support the circulation. On the 24th Lima measured 50 kn blowing 23-ft seas. A frontal wave swept past Denmark and 10,000 trees were uprooted. One-third of the houses in northwest Jutland were damaged. Two fishermen drowned and a ferry with 53 passengers ran aground.

On the day before Christmas there were two small LOWs off the East Coast, another south of Lake Erie, and another over Quebec. A very large 1047-mb HIGH was centered over Nebraska. By Christmas Day the Quebec LOW had moved southeastward to slightly north of Anticosti Island. Winds gusted to 60 kn in Hampton Roads on Christmas Day as the system strengthened after passage of the front. Three empty colliers collided. The ESSI CAMILLA dragged anchor and drifted against the MERCEDES MARIA, and both vessels drifted about 5 mi and struck the NAIAD. At the time there were more than 100 colliers in Hampton Roads. Yet another LOW had formed over the Labrador Sea. This last LOW consolidated the circulation. There had been a few gales, and south of the front there were waves of 15 to 25 ft. By 1200 on the 26th this LOW was 960 mb east of Cape Chidley. The MEEREKATZE at 60°N, 48°W, had 54-kn winds and the ZAPA near 47°N, 48°W, measured 64 kn. The MONSOON (50°N, 41°W) had 28-ft waves. In the southwesterly flow southeast of the front many ships found 20- to 25-ft waves. On the 27th at 0000 the 958-mb LOW was very near Godthab, Greenland, which measured 50-kn winds. A small 968-mb indentation was found on the east coast of Greenland near Angmagssalik. By 0600 it appeared the main low-pressure center had jumped across the ice cap to the east coast LOW, now 958 mb. The weather station on the icecap near 65°N had 60-kn winds. Many ships in the area of the storm between 55° and 65°N and west of 15°W were reporting winds over 51 kn. The ENGEY (64°N, 27°W) had winds as high as 68 kn. Most were not reporting waves, but the GRON-

Figure 49.--High waves riding atop high tides crash against a pier and breakwater north of Cape Fear. Star News Photo by Dan Sears.

LAND (60°N, 22°W) had 33 ft. They increased to 36 ft with 60-kn winds on the 28th. Late that day the LOW was centered near 75°N, 0°W, at 944 mb. Platforms in the northern North Sea had winds of 50 kn. It is doubtful there were any ships in the area. Meanwhile, another LOW had formed over Greenland's east coast near 68°N by the 29th. The icecap was again getting 60-kn winds; no waves were reported. The GRONLAND (60°N, 26°W) now had 26-ft seas and Lima 23 ft. The reporter GZOQ (60°N, 0.6°W) had 60 kn and 33 ft. Another LOW was moving past Kap Farvel holding the strong westerly flow across the water north of 50°N latitude. This LOW raced eastward across Iceland, again bringing severe weather to that part of the northern ocean.

On the 26th a high-pressure cell moved off the East Coast near Norfolk. This brought easterly winds to the coast south of there. On the 27th another HIGH was pushing eastward across southern Canada and reinforced the first HIGH continuing the easterly winds. At the same time a LOW developed off Jacksonville, Fla., in an inverted trough. This intensified the easterly winds along the Carolina coasts. Wind-driven waves on top of high tides caused heavy damage to beaches, piers, and beach homes (fig. 49). Carolina Beach and Wrightsville Beach north of Cape Fear were particularly hard hit with several piers and many homes extensively damaged. Up to 3 in of rain fell in the area contributing to erosion problems. The LOW remained stationary south of Cape Fear for about 48 hr. The HIGH was southeast of Newfoundland on the 29th, easing the gradient and the force of the easterly winds.

Monster of the Month (North Atlantic)--This was the same type storm that struck the Carolina coast, described above, and occurred at the same time. It was the result of a high-pressure system that moved eastward across the Atlantic paralleling latitude 40°N. At 0000 on the 27th it was 1052 mb near 43°N, 22°W, or about 600 mi west of Cape Finisterre. On that analysis a LOW had formed over Italy increasing the gradient over the western Mediterranean. Later in the day another LOW formed over southern France, further increasing the pressure gradient. This LOW moved southward toward Constantine, Algeria (fig. 50).

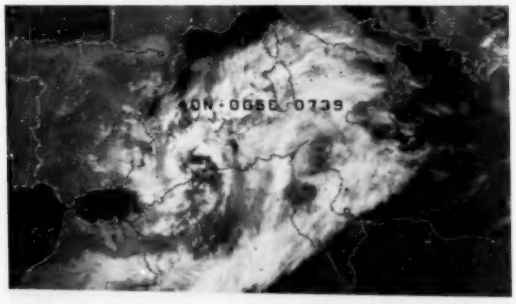
Winds gusting to 70 kn and waves of 25 ft hit the Algerian coast. The ports of Oran, Arzew, Ghazaouet, and Benisaf were particularly hard hit. In Benisaf 22 trawlers were sunk. At Oran five freighters were sunk and many aground and badly damaged. One report said 20 ships were sunk or badly damaged. Torrential rains with snow accompanied the winds. Several people were killed. Piers, breakwaters, and harbor walls were severely damaged.

The eastern coast of Spain was hit by 60-kn winds and 20-ft waves. It appeared more people were killed in Spain than Algeria. On Majorca the waves reached 36 ft, destroying many yachts and boats. The orange crop at Valencia was badly damaged.

Some of the ships that were affected by the storm, in no particular order, included the JUAN A. LAVALLEJA, MAMMOTH SCAN, GOLDEN STAR, FINNTRADER, HUELVA, JACOB BECKER, CHERCHELL, TEBESSA, KAPETAN MARKOS, OUED SOUF, SIVIGLIA, BASTABALES, BENI SAF, SARONIC SKY, CONSTANTINOS, GOGO RAMBLER, IBN ROCHD, ALGERIA, SAM ALEX, INDIAN SECURITY, FAMILY DELTA, VOMAR, BERYTE, ANNA, GIANNIS XILAS, BELAHCEL BOUZEGZA, and the AL SOLAIBIAH.

The LOW crossed the Algerian coast at 0600 on the 28th and stalled near 32°N. The HIGH moved over France at 1042 mb on the 29th. It moved to longitude 10°E before retreating westward on the 31st. The LOW disappeared late on the 31st as the HIGH joined with another approaching from the west. The pressure gradient, winds, and waves were now normal.

Casualties--As if the above were not enough, there were many more this month. Fog was not much of a problem. The DEVALI I and MARSHINA G. collided in fog on the 2d near Louisiana. The ferry PRINSES-SAN DESIREE and STENA TIMER collided near Gothenburg on the 11th. The CHALLENGER, MARACAIBO, and SANKO MAPLE suffered unspecified damage. On



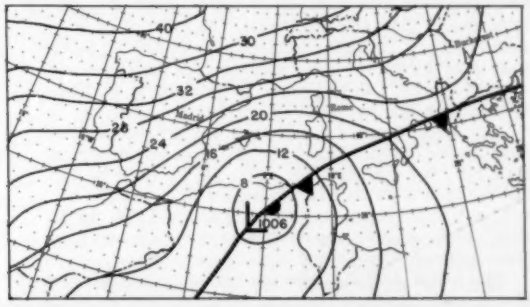


Figure 50.--The storm was centered very near Algiers when this image was taken at 0740 on the 28th. The surface analysis shows the storm at 1200.

the 3d the HANSEAT, LACKENBY, and NORWEGIAN CHALLENGER had weather damage near England. The tanker ASTORIA arrived St. Michael's on the 4th with damage. The MIRANDA grounded in the Weser River, and on the other side of the ocean the dredger SUSANA sank off Coatzacoalcos. In the Mediterranean the AFOVOS, AGIP MILANO, MARK IV, and STARMAN AMERICA had weather problems. The HALLFAX had weather problems off Gaspe in 50-kn winds and part of the crew was evacuated by helicopter.

The weather over the eastern Mediterranean continued to plague ships from the 7th to the 10th. The ANGELIKI Z lost control off the Albanian coast. The GEORGIOS D., OSWEGO CONCORD, and VOSGES had weather problems. The TENIA II anchored off Turkey to inspect their cargo after heavy weather in the Black Sea and stranded in strong northerly winds. On the 11th the barges TRINACRIA PRIMO and TRINACRIA SECONDO sank on the Israel coast during a storm. That same day the LOUCY sank off Karpathos Island. The crew of 14 was rescued by helicopter. The bulk-carrier D.G. KEER sank near Santa Marta Island due to leakage in bad weather while being towed.

The CON ZELO struck a quay at Treport. The SAUDI INDEPENDENCE drifted into the WILD FLAMINGO at Bremerhaven in high winds on the 17th. The JUNIPER sustained heavy weather damage on the 19th enroute to Marseilles. The ANNA DRENT lost containers overboard off Greece on the 19th in heavy weather. The DOMINION UNITY and GIANNAKIS collided during bad weather on the 19th at Perama.

The T.R. MCLAGAN and H.M. GRIFFITH suffered damage when they brushed in ice in Quebec harbor on the 22d. The LAKESHELL grounded on Telegraph Rock in near gale-force winds and heavy ice. The CHARLOTTE MAERSK arrived Savannah on the 23d with damage to containers. The SUNNY BETTINA lost steel pipes overboard off Brest on the 27th in adverse weather. The JEANNIE dragged her anchors in severe winds at Narvik and collided with the FIRST VENTURE on the 28th. The LAGO LLANQUIHUE reported weather damage on the 30th. The ASEAN KNOWLEDGE under tow to Baltimore by the HEIDE MORAN was hove to on the 30th in gales and heavy seas on the 29th and 30th.

The SWEDE TONIA encountered heavy weather off South Africa on the 21st, 23d, and 24th.

ROUGH LOG, JANUARY 1981--The most traveled storm path was from about 400 mi east of Cape Hatteras to the Denmark Strait. The area of cyclogenesis off the U.S. East Coast was about 200 mi farther east than usual. Fewer storms than usual passed over the Great Lakes Basin. Three storm systems affected the central Mediterranean.

The mean sea-level pressure pattern was shifted counterclockwise. The Icelandic Low was a normal 1001 mb, but shifted from 60°N, 35°W, to 58°N, 54°W. The Azores High was 13 mb higher than normal at 1033 mb and from near 35°N, 20°W, to 43°N, 20°W. This produced a strong northwest-to-southeast gradient between Kap Farvel and the Azores.

The North Atlantic was dominated by a large plus 18-mb anomaly centered near 48°N, 19°W. Positive values covered the area east of 50°W and south of Iceland to 15°N and Europe except Scandinavia. There was a weak minus 5-mb anomaly that covered eastern Canada and southward over Nova Scotia.

In the upper air there was a major sharp trough off the East Coast. Both the upwind and downwind ridges were much sharper than normal. This brought more northeasterly flow over the major shipping lanes.

Extratropical Cyclones--The first severe storm to form this month was discovered near Cape Hatteras on the 0000 chart of the 2d. The CHEVRON KENTUCKY (39°N, 60°W) reported 48-kn southerly winds at 1800. On the 3d several vessels found winds near 50 kn. The CANADIAN CJR6 reported 55-kn winds twice near 44°N, 59.5°W. At 1200 the seas were 20 ft and swells were 34 ft. The LOW was 972 mb over the Strait of Belle Isle. There were winds up to 60 kn early on the 4th and 74 kn at 1200. They were reported by the Canadian ships ALGOSEA (48°N, 63°W) and the VOBJ (48°N, 50°W). For some reason they were not reporting waves. On the 5th the LOW was over the Labrador Sea. A deepening frontal wave was traveling northward over Newfoundland and absorbed the circulation late in the day. It brought strong gales to the Grand Banks. The GEORGE WYTHE had 45-kn winds west of the front near 40°N, 61°W. Later, another ship had thunderstorms with 20-ft waves at the cold front.

This storm came out of the northern plains of Canada west of Hudson Bay. On the 7th it was north of Lake Ontario and its southerly winds were offshore. By the 8th there were some strong winds ahead of the cold front. A ship at 36°N, 67°W, had 45 kn with 25-ft waves. At 0600 the CGYM reported 68-kn southeasterly winds at 47°N, 59°W. The storm was now traveling a path similar to the prior storm, but lucky for any ships near Labrador, it was farther inland. At 1200 the storm was 973 mb at 51°N, 65°W. There were 50- to 60-kn wind reports south of Newfoundland at 1800. On the 9th a ship off Hamilton Inlet had 23-ft seas, and the MEERKATZE near Sondre Stromfjord had 58-kn southerly winds driving 20-ft seas. The storm continued northward and dissipated on the 10th near Baffin Island.

As the storm above moved over the Davis Strait, the front broke off over Greenland on the 10th and continued eastward. A ship near 62°N, 31°W, reported 50-kn winds east of the front. On the 11th an Icelandic ship near 63°N, 16°W, had 52-kn winds. A new low center had formed near Scoresby Sound. By 0000 on the 12th it was 960 mb near 72°N, 14°E (fig. 51). Ships and platforms on the North and Norwegian Seas were being hit by 45- to 55-kn northwesterly winds with 20-ft seas. The ESSO WARWICKSHIRE (61°N, 02°W) had 59-kn winds in subfreezing temperature. The storm moved across Nordkapp on the 13th as another storm center roared across Iceland.

This was another of those storms that generate on the southeast coast of Greenland when a storm moves northward through the Davis Strait. At 1200 on the 13th the LOW was over Iceland. Ocean Weather Station Lima measured 40-kn winds and 20-ft waves in the warm sector. Twenty-four hours later the storm was 958 mb near Molde, Norway. Lima now had 50-kn winds and 30-ft waves. At 1800 a platform near 56°N, 03°E, measured 60-kn winds. On the 15th there

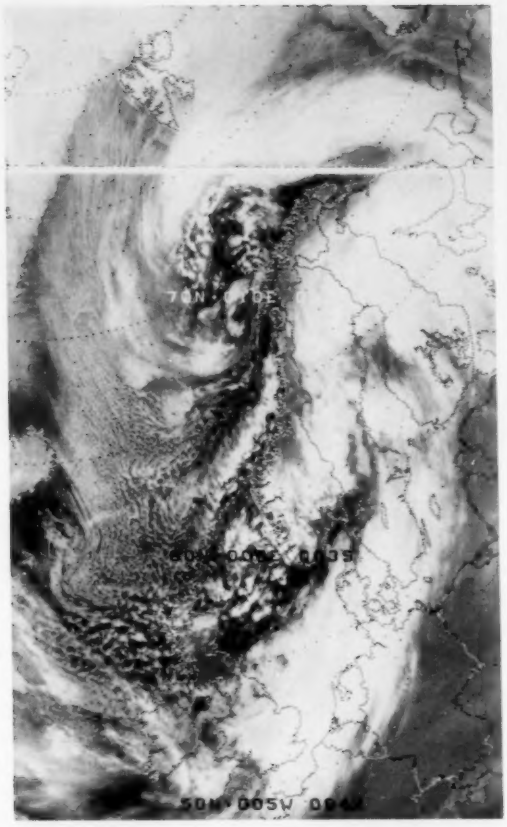


Figure 51.--This far-north storm is blasting ships and platforms on the Norwegian and North Seas. The edge of the sea ice can be seen off the Greenland coast and northwest Iceland.

were many reports of winds of 45 to 60 kn in the North Sea area with waves up to 33 ft (fig. 52). At 1800 one RIGG at 60.7°N, 01.7°E, reported the winds as 85 kn with 34-ft waves, and another at 60.5°N, 02°E, called the winds 50 kn and the waves 43 ft. The high winds and waves continued into the 16th, but by afternoon had decreased to reasonable values.

As the front from the storm described above moved south of the Alps, a LOW formed late on the 15th over the Adriatic Sea. Strong northwesterly winds were blowing off France and Spain and southwesterly winds south of Italy. A French ship south of Greece reported 70-kn winds. The NORDPOL off the south coast of Sicily radioed the winds as being 54 kn and the seas 16 ft. At 1200 on the 16th the LOW was 980 mb at 40°N, 20°E. Two ships reported 54-kn winds north of Libya. On the 17th the TOKIO EXPRESS (35°N, 21°E) had 50-kn winds with 23-ft waves. On the 18th the weakening storm was over Turkey.

North winds over 50 kn lashed southern Italy with rain and snow. Trees and walls were toppled. Pounding surf inundated villages in northeast Sicily. Power-

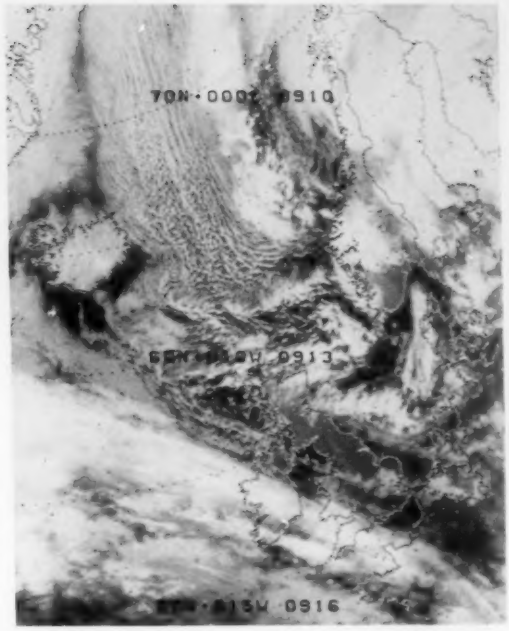


Figure 52.--The storm is centered off central Norway. The cloud streaks indicate cold air flowing over warmer water. This results in low-level instability.

lines and pylons were downed. Ships dragged anchor and broke moorings. Several sank. Among those involved were the EKTON and OCEAN FRIEND, CHEMICAL CHALLENGER, and RIVA 1. The GOLDEN PRINCESS sank at Perama and the DENIZ SONMEZ sank off Crete.

This storm had a cold origin near Lake Winnipeg. By 1200 on the 15th it was over Norfolk, Va. As it moved northeastward over the Gulf Stream, it intensified but had little affect on shipping except for gales until the 18th. At 1200 the storm was 972 mb near 60°N, 18°W, and relatively small; only about 1,000 mi in diameter. As it passed north of OWS Lima she suffered 65-kn winds with 26-ft seas and 33-ft swells. At 1800 the winds had decreased to 45 kn, but the waves were still 31 ft. The DISKO (59°N, 15°W) and the GARBETA (57°N, 11°W) now had 60-kn winds with 33-ft waves. The storm was blasting the North Sea on the 19th with winds over 60 kn and waves over 35 ft. The DISKO was traveling east with the storm and had 68-kn winds and 59-ft waves at 0600 near 59°N, 13°W. On the 20th the storm was headed northward and quickly weakening.

On the 0000 chart of the 17th there was a flat trough off the U.S. East Coast. By 1200 a LOW had formed east of Long Island (fig. 53). By 0000 on the 19th the U.S. ship NANT reported 72-kn winds from the northwest southeast of Cape Cod. Later three Canadian ships had 45- to 52-kn winds south of Newfoundland. Ships were finding 20 ft waves as far as 1,000 mi south of the center. A ship found 61-kn winds at

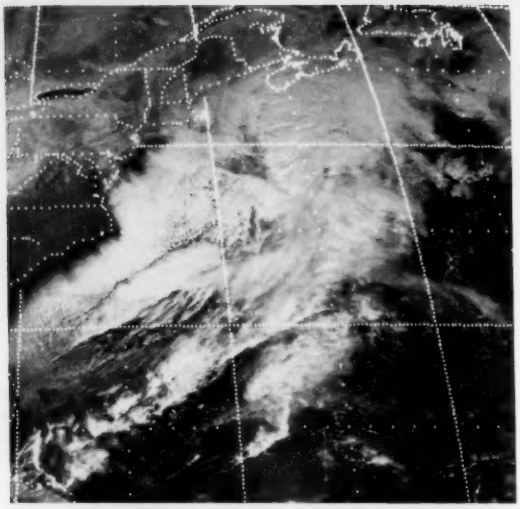


Figure 53.--The LOW is forming off Long Island under the large cloud shield, but it is not very well organized.

47°N, 48°W, at 2100.

At 1200 on the 19th the 960-mb storm was centered east of Belle Isle. Seven ships east of Cape Race radioed winds higher than 44 kn. The MARSEILLE had 56-kn winds and 49-ft waves near 45°N, 37°W, east of the cold front. The AMERICAN ALLIANCE was right at the front (45°N, 40°W) but the winds had shifted out of the south with 45 kn and 26-ft waves. Several ships reported waves up to 33 ft. On the 20th the CG11 had 65 kn near Sydney.

As a LOW moved across the southern Norwegian Sea on the 19th, a LOW formed over Denmark. After the front crossed the Alps on the 20th another LOW formed over the Ligurian Sea. The VENDEE was west of Corsica with 55-kn winds and 25-ft swells. Two other ships nearby had winds near 50 kn with 18-ft seas.

At 1200 on the 21st the storm was 976 mb near 36°N, 17°E. There were 40-kn winds on the coast of Libya. On the 22d there were 45- to 60-kn winds with waves up to 34 ft between 10°E and 25°E (fig. 54). A SHIP at 41°N, 11°E, reported 61 kn. The KARAGANDA (38°N, 10°E) reported 33-ft swell waves. Another SHIP near 36°N, 16°E, reported 48-kn winds and 34-ft seas. Bari on the northeast coast of Italy measured 40-kn winds as the strong winds over Libya moved to Tobruk.

The storm weakened slightly on the 23d and 24th, but land stations still measured 40-kn winds. On the 25th the spent storm moved eastward along Turkey's south coast.

The GUUL VICTORY lost tow of the IBIS BARGE off Malta on the 21st and it grouded at St. Julian's Bay. The APOSTOLOS M. I. took water in hatches south of Sicily on the 22d. The TARA sustained damage during voyage off Greece 22d to 25th. Also, the NANO K. grounded off Greece on the 25th.

The southern tip of Italy and Sicily suffered heavy damage with winds over 50 kn. Gales and blizzards raged for 36 hr. Buildings were damaged, villages

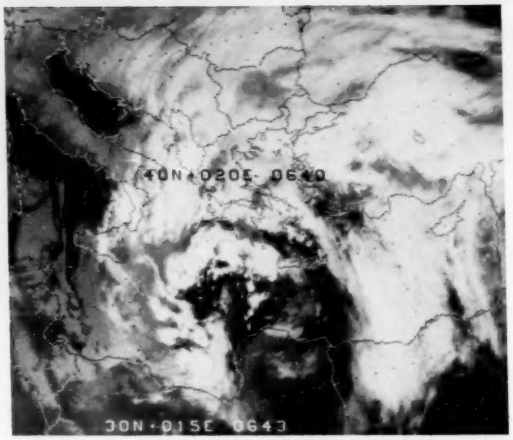


Figure 54.--Cumulus clouds surround the center of the storm. The clouds rapidly cut off the African coast, indicating the dryness of the desert air.

isolated, and shore installations damaged. The earthquake victims near Naples were hit hard by the cold, snow, and high winds. Tents and trailers were blown over. Electricity and water was out in many areas.

Greece was hit by gale-force winds and ports were closed to small vessels. Cold temperatures with rain and snow disrupted communications and travel.

A weak LOW was found south of Lake Superior on the 28th. It was still weak as it moved over Long Island on the 29th, but strengthened in the next 24 hr over the warmer water. It was moving around the southern periphery of a LOW south of Kap Farvel that was producing gales and 20-ft seas. The TEXACO MASSACHUSETTS south of Cape Sable found 48-kn winds. The FEDERAL RHINE 200 mi south of the center had 50-kn winds. By 1200 on the 31st the 984-mb storm had sped to 52°N, 40°W. Several ships had winds near 50 kn. The ZIM MONTREAL (44°N, 39°W) had 55-kn winds. The storm moved northward, west of OWS Charlie, and on February 1 had 45-kn winds with 23-ft seas. The storm moved over Iceland on the 2d. At this time it was producing only gales with an isolated strong gale according to the reports on radio. Ships south of Iceland were reporting waves up to 23 ft. On the 4th the storm moved over Norway and out of the area of primary interest.

Casualties--There were reports that the following ships suffered heavy weather damage: ANNA, DIONE, ENGEDI, GELINDA, HALCYON MED, JUNIOR K., KADERBAKSH, MEDITERRANEAN SUN, MOLISTA, NASEEM, OGUY, ROSINA TOPIC, SAUDI CROWN, SOCA, and THEOTOKUS. The following ships collided in fog: BLACKTHORN and FREDERIKA 1 at Greenwich Reach, FLANDRE and APRICITY at River Scheldt, INSELSBERG and JAGAT KIRTL at Schulp, LUBECA and VOLGO-BALT in Kiel Canal, and SAINT GERMAIN contacted a pier at Dover. The TEMSE grounded in the River Scheldt in poor visibility on the 28th. The RIMBA MERANTI sustained propeller blade damage in ice off Finland. The IBN SIRAJ had ice damage to the pro-

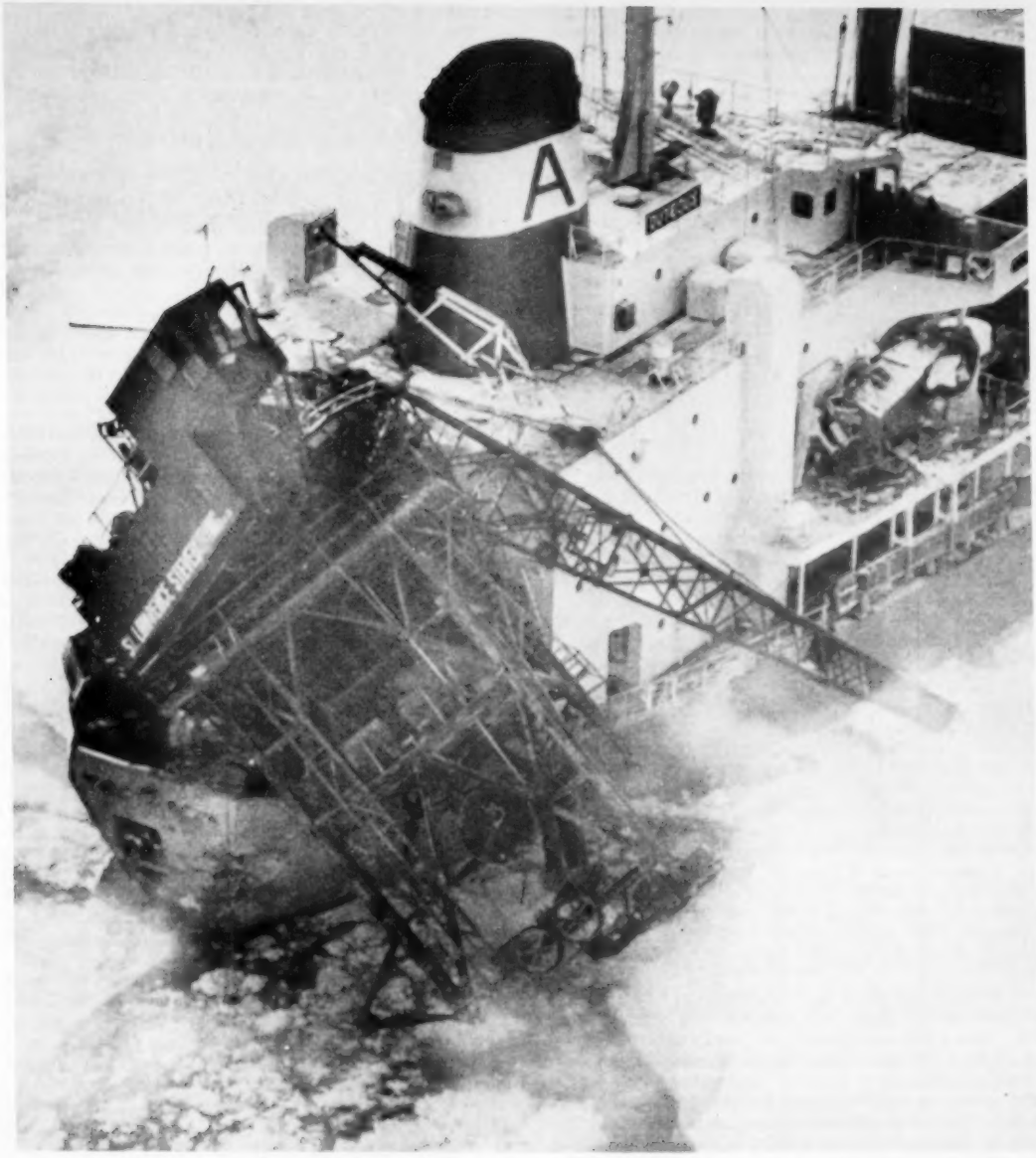


Figure 55. -- One of the large Stevedore cranes hangs off the stern of the DUTEOUS as she continues to float down the St. Lawrence River with the massive ice flow. Wide World Photo.

peller in the St. Lawrence River. The BUNGA CHEMPAKA had ice damage near Montreal. The WORLD KINDNESS sustained ice damage at Quebec. The Panamanian freighter (8,767 tons) DUTEOUS knocked over two cranes at Montreal when she was pushed into a pier by massive ice floes in the river (fig. 55).

The FJALLFOSS sent a Mayday on the 3d about 130 mi west of Faroe Islands after taking on water in force 8 to 9 winds. The NOBLE FIVE reported heavy weather in the Mediterranean Sea from the 3d to the 7th. The RAYES grounded in the Gulf of Asinara on the 6th in bad weather. The TIMGARD developed a list when timber cargo shifted in bad weather off Bornholm on the 8th. The GRIGORIOS C. IV and VRANCEA contacted at Alexandria while at anchor. The ORAN and VENCEMOS dragged anchors in high winds in Cristobal on the 13th.

The ALGOL grounded off Turku, Finland, on the 16th. The crew was rescued one by one by helicopter in force 10 winds and a snowstorm. The ABED AL

SALEM had containers break loose in bad weather off Crete. The EVANGELISTRIA V ran aground and was abandoned by her crew on the 19th near Oristano. The IBIS BARGE parted from tow of the GUUL VICTORY off Malta on the 21st. The APOSTOLOS M.I. took water in rough seas near Malta on the 22d.

The 70,341-ton Greek bulkcarrier DEIFOVOS sank off the Norwegian coast in heavy weather on the 25th that included 33-ft seas and a blizzard. One hatch cover had been torn off. She was carrying 66,000 tons of iron ore and developed a 20-degree list--a half-hour later it was 45 degrees. Helicopters rescued 29 survivors with 5 dead and 4 missing.

The ANASTASIA encountered bad weather in the Aegean Sea with heavy pitching and rolling on the 27th and 28th. The ANDREAS N. HADJIKYRIAKOS and the UNIQUE CHALLENGE contacted in heavy weather at Alexandria on the 30th. On the 31st the SUNWAVE and PERRYVILLE had a collision in fog off the Bolivar Peninsula.

Four crewmen died when the 5,400-ton EMS and 2,168-ton UNDINE collided in fog off the Norfolk coast on the 30th. Two people were injured and 17 were rescued by 3 vessels.

Rough Log, North Pacific Weather

December 1980 and January 1981

ROUGH LOG, DECEMBER 1980--Climatologically, this was an anomalous month. Both the storm tracks and mean-pressure pattern were vastly different from the long-term normal. Climatology indicates the storm tracks from the vicinity of Japan tracking northeastward to Kamchatka or to the western Aleutian Islands, then eastward into the Gulf of Alaska, and also from midocean northeastward to the Canadian coast. This month the primary track was from east of Japan eastward to the vicinity of 155°W, then north and northeastward into the Gulf of Alaska. This placed the trace of the storm centers much farther south than usual.

The pressure pattern reflected the paths of the storms. The normal indicates the Aleutian Low with two centers less than 1000 mb, one near the Rat Islands and the other about 250 mi southeastward of Kodiak Island. This month the Aleutian Low was 993 mb near 44°N, 167°W. This was about midway between the two climatic Lows but about 10° latitude farther south. The Low also penetrated much farther south, to the latitude of Hawaii. The Pacific High was near normal off the California coast. Either as a result of or contributing to the southerly position of the Aleutian Low, a long tongue of the Asian High stretched across the Chukchi Sea into northwestern Canada.

There were two large anomaly centers. The most immediate one for ships was minus 17 mb near 40°N, 162°W. The other was plus 18 mb over eastern Siberia near 65°N, 170°E. The zero isoline waved along the 50°N parallel.

The upper air height pattern reflected the surface pattern. There was an anomalous Low near 46°N, 170°W, in addition to the normal Low near Sakhalin Island. There was also an anomalous High over eastern Siberia, north of and between the two Lows.

Tropical storm Ed plied the far western ocean.

Extratropical Cyclones--A frontal wave was the origin of this storm. It moved eastward but on the 3d turned southeastward as it responded to an upper air cutoff LOW. On the 4th there were a few gale reports west of the 992-mb center, with the SANKOSTAR at 34°N, 166°E, reporting 26-ft waves in northeasterly winds. The storm turned northeastward on the 5th as it moved to the eastern side of the upper air LOW. At 1200 on the 5th the storm was 984 mb near 33°N, 166°W. The TOWNSEND CROMWELL at 26°N, 171°W, found 45-kn winds with 20-ft swell waves. On the 6th the primary upper air LOW was near 46°N, 173°W. There were two other surface LOWs associated with the upper air center and this LOW was joining them. The wind wave analysis (fig. 56) showed an area of 12-ft waves, but it did not indicate the 30-ft swell waves reported by the VALENE near 28°N, 163°W. The FALCON BAY, not far away near 26°N, 165°W, reported 68-kn winds as she passed through a trough behind the front. By 1200 on the 6th two of the three LOWs had combined into one and this one became the primary storm. At 0600 the CGC SHERMAN near Adak Island reported 55-kn winds with 21-ft seas and at 1200 the STORIS near Unimak Island radioed winds of 60 kn driving 25-ft seas (see wave analysis). The SHERMAN was still having 60-kn winds on the 7th, and the SILVER PHOENIX, about 250 mi to the south, was contending with 31-ft seas and 50-kn winds. Saint

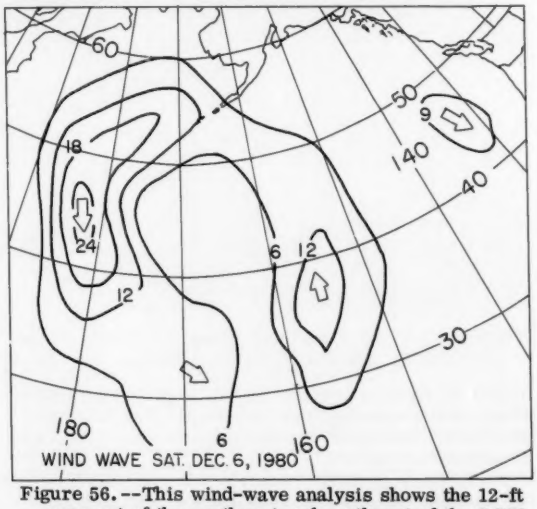


Figure 56.--This wind-wave analysis shows the 12-ft seas out of the southeast and southeast of the LOW. It also shows the area of 25-ft seas west of the storm after consolidation of the centers.

Paul Island measured 50-kn winds. The NEW GOLDEN PHOENIX (48°N, 170°E) was on the western edge of the storm with 65-kn winds. Swell waves of 20 ft were fairly common. At this time the storm was 960 mb.

By the 8th the winds were generally gales, but to the south of the LOW some swells had built as high as 31 ft with 10 to 15 ft much more common. At 0000 on the 9th a ship reported 45-kn winds about 200 mi west of the center and at 1200 the PRESIDENT TYLER (40°N, 168°W) was sailing with 25-ft swells on her stern. The surface LOW was nearly vertically alined with the upper air and moving in small loops. On the 10th it became stationary before being absorbed on the 12th.

This storm formed over the Sea of Japan late on the 8th. It moved across northern Honshu on the 9th and continued on a due easterly track. By 1200 on the 11th it was near 42°N, 163°E. Two Japanese ships near 40°N, 160°E, had 45-kn winds. At 2100 the ASIA MARU (40°N, 166°E) had 60-kn winds. Two ships almost 400 mi west of the storm center had swell waves over 30 ft on the 12th. At 0600 on the 13th the CGC MUNROE was near Lisianski Island with 45-kn winds. There were two reports of swell waves over 30 ft southwest of the 980-mb LOW. At 1200 a ship had 36-ft swells northwest of Midway. The NEDLLOYD NAGOYA (29°N, 157°W) was near the front at the time of the 0000/14 analysis and was sailing into 60-kn winds and 49-ft waves. On the 14th and 15th the TYSON LYKES was between 24°N, 176°W, and Honolulu with force 6 winds, but the swell waves ranged from 20 to 25 ft. On the 15th the DANAH was north of the LOW with 47-kn winds and 33-ft swells. On the 16th the swells were 25 ft. By 1200 the LOW had dissolved.

So far this month, high pressure had dominated eastern Siberia, the Bering Sea, and, to a lesser extent, Alaska. There was a weak low-pressure area over Alaska on the 15th and 16th, but high pressure was building in rapidly from the Arctic Ocean on the 17th (fig. 57). By the 0000 analysis on the 18th there was a 1064-mb HIGH over the Alaska-Yukon border and the Yukon River. High pressure remained over the area gradually decreasing to 1011 mb by December 30.

This LOW came off the Korean Peninsula on the 10th. It was pulling very cold air off the Asian mainland over the Sea of Japan. By 0000 on the 13th the 982-mb storm was over the Tartar Strait. The front had swung as far east as 153°E. There were over half a dozen ships along and east of the front with winds greater than 41 kn. The JINDALLE (46°N, 155°E) found 58-kn winds with 20-ft waves. The AMERICAN CHIEFTAN (34°N, 152°E) had 25-ft swells. At 1200 the GBQX (35°N, 154°E) found 50-kn winds, 20-ft seas, and 44-ft swells.

The LOW was drifting eastward. A frontal wave moved northward then northwestward and reinforced the storm. On the 14th and 15th isolated ships reported winds up to 50 kn and waves to 30 ft. On the 16th the LESLIE LYKES called the winds 55 kn and the waves 33 ft. A new LOW had formed to the south. It moved eastward then curved northwestward. On the 16th this became the more powerful storm (fig. 58). The CHARLES LYKES (48.5°N, 173.3°W) had

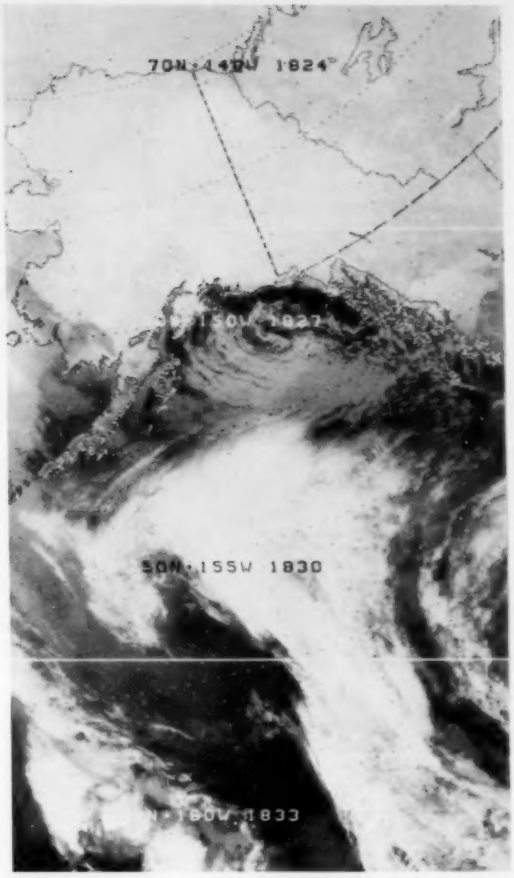


Figure 57.--Due to lack of contrast in the temperature of the clouds and the snow cover, the high-pressure area over Alaska and the Yukon cannot be seen in this infrared image. A small HIGH can be identified over the Gulf of Alaska, and the dividing line between cyclonic and anticyclonic flow is visible along a line from the Fox Islands to the Queen Charlotte Islands.

cargo handling equipment break loose with damage to it, the hull, and cargo. Several ships reported 60-kn winds on the 17th and waves as high as 38 ft. The LESLIE LYKES was still calling the winds 55 kn and had the 38-ft waves. The WRANGELL MARU at 50°N, 169°W, had 65-kn winds. The PRESIDENT TAYLOR was north of the Aleutians with 50 kn and 25-ft waves on the 18th. The DIANA nearby called the windspeed 72 kn. The two LOWs combined on the 18th and then broke into multiple weak centers.

This storm started with one of the LOWs that split out of the previous storm. The center traveled southward, then eastward. On the 21st the storm was near 46°N, 161°E, at 977 mb. Several ships had gales and strong gales. The PRESIDENT KENNEDY (43°N, 148°E)

Figure 58.--This powerful storm has turned northwestward as it came up against the intense HIGH over Alaska.

had 45 kn and 30-ft seas. The FORT VICTORIA found 47-kn winds and 30-ft swells near 34°N, 172°E, on the 23d. She ran into 39-ft swells on the 24th, but the storm was weakening.

This storm was the consolidation of several small LOWs north of Hawaii on the 22d. It was 970 mb on the 23d. There was a strong gradient north of the center. A ship was near 54°N, 154°W, with 60-kn winds. There were reports of gales on the 24th. With the demise of the storm above, this storm, though not particularly severe, covered the northeastern ocean north of a line from California to Hawaii and east of 180°. The most vicious part of the storm was the waves. On Christmas Day the British GOVH (30°N, 159°W) had 55-kn winds driving 33-ft seas and 39-ft swells. Others were having 20 to 30 ft. The storm stalled near 50°N at this time as other centers moved through the eastern circulation. The winds now were mostly gales with waves of about 20 ft. This storm system was the first to approach the North American coast since the 14th.

The point of occlusion of a front near Tokyo produced this LOW on the 23d. It deepened rapidly and by 0000 on the 24th was producing winds over 50 kn and waves over 25 ft. A U.S. ship, sailing toward Tokyo, had 54-kn winds and 15-ft waves. On the 25th the JINDALLE had departed Tokyo Bay and had 64-kn winds out of the north with 41-ft swells. Other ships had winds around 50 kn and waves of 20 to 30 ft. The charts on the 26th had many high wind and wave reports. The AMERICAN LEGION (35°N, 159°E) had 33-ft waves, and the FORT VICTORIA (33°N, 159°E) had 51-kn winds and 46-ft swell waves. Waves of 20 to 25 ft continued into the 27th. The LOW dissipated by the 28th.

Monster of the Month, North Pacific--This storm was a series of LOWs that were very hard to accurately track from one chart to another. The previously de-

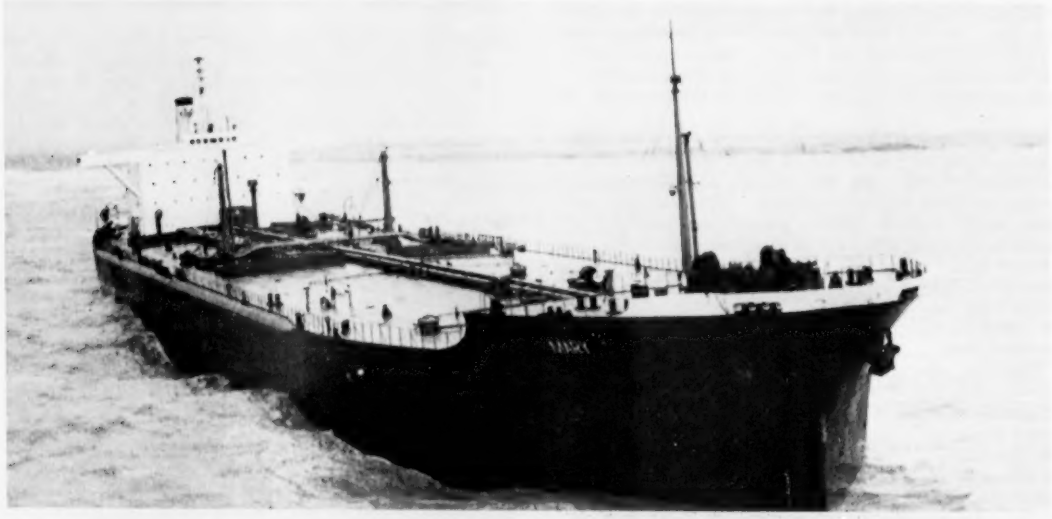


Figure 59. -- Wind wave analysis December 26th showing significant wave heights of 24 ft.

scribed storm was actually the first one in this series. On the 26th a LOW formed east of Tokyo (fig. 59). At 1200 the NEW GOLDEN PHOENIX was near the center of the new circulation and reported 54-kn winds. On the 27th two ships in the area of 35°N, 150°E, had near 60-kn winds. Others farther south had 25-ft waves. There were still winds of 50 kn and waves up to 33 ft on the 28th (fig. 60). The Liberian bulkcarrier WORLD FUJI with 11,000 tons of coal developed a crack in her hull while anchored off Amagasaki port on the 27th in strong winds. Twenty-seven of the 29 crewmen were transferred to Japanese vessels. The bulkcarrier ARTEMIS laden with logs took water through No. 1 hatch in heavy weather on the 28th about 270 mi southeast of Nojima Saki. The crew was rescued and a tug was standing by to pump out water for towing.

The Yugoslavian bulkcarrier DUNAV (25,200 tons) with 31 aboard sent a distress signal on the 28th while about 700 mi southeast of Chiba. She was taking on water in stormy seas, and all contact was lost. She was presumed lost after an air and sea search failed to locate the ship.

Figure 60. --The satellite image very graphically illustrates the violent winds that were battering Japan and ships in the vicinity.

The ONOMICHI MARU (56,341 tons) was in distress from taking on water in cracks in her bow from rough seas on the 29th. She was about 800 mi southeast of Nojima Saki. The Japanese ore carrier DAMPIER MARU was standing by to rescue the crew. The Indonesian GARSA TIGER (3,139 tons) sank in rough weather near 29°N, 132°E, on the 29th. Eighteen crewmen were rescued, 11 by the ROYAL EAGLE and 7 by helicopter from a liferaft. Six were missing.

The VISHVA AMITABH and the SEIUN MARU No. 10 collided in strong winds on the 28th in Mutsure Anchorage.

At this time it appeared that the original LOW had disappeared, and new ones developed both to the east and west. The winds were mostly gales, but there were isolated reports of 50 kn. The waves were 20 to 25 ft, but the TAGALUS (30°N, 138°E) found 43-ft waves. The westerly flow had persisted in this area for many days. On the 30th there were three ships near 31°N, 152°E, with winds near 50 kn and up to 30-ft seas and swells.

There was now a large cyclonic circulation with multiple centers that reached from coast to coast and 25°N to the Bering Strait. At 1200 the analysis showed eight low-pressure centers in or on the periphery of this circulation. High winds and seas accompanied the various centers as they developed and then dissipated. Generally, winds were gale force and waves ranged from 20 to 25 ft. The large system started breaking up on January 3.

Tropical Cyclones, Western Pacific--Tropical storm Ed was first observed as a disturbance near Yap on the 14th. Moving westward at 12 to 15 kn he began to organize. By the 16th maximum winds climbed to 50 kn around a 991-mb pressure center. Maximum winds were observed in the northeast quadrant of the storm. However, Ed was moving into an area which was considered unfavorable for continued development. On the 17th he began an erratic clockwise loop some 150 mi east of the central Philippines. A strong surface ridge extended from the Asian mainland north of the storm and maintained a strong northeasterly low-level flow in the vicinity of the Philippines. At the same time a strong southwesterly flow at 200 mb was present off the east coast of the Philippines. The resultant strong wind shear caused Ed to weaken. After most of his convection had been sheared off, Ed began moving southwestward on the 20th. By the 24th he had dissipated over northern Mindanao.

Casualties--The following ships either reported heavy weather damage or requested a survey this month. They were the AEGIS DORIC, KYOTO, REGAL SCOUT, SISSILI RIVER, APLI CHAU, SEMIRA, AQUAGEM, KILMORE, BARRY, ISLA FLOREANA, DELTA VENTURE, VELA, Barge CMC 450-10, and MARTHA MARINER.

The 29,398-ton Peruvian bulkcarrier CAPIRONA cracked her hull near 27°N, 168°E, on the 5th. All of the crew were safely taken aboard the NEW SULU SEA. The tug SMIT NEW YORK located the vessel in 20-ft

seas. The tug MOANA HOLO was at Midway awaiting salvage and survey party. The winds were 50 kn and seas 24 ft at Midway.

The 83,729-ton American LNG carrier LNG TAURUS ran aground near Moji, Japan, in the Mutsure Anchorage on the 12th in strong northwest winds. She was freed on the 16th. Her master reportedly shot himself. The MOCK NAN also grounded in strong winds on the 13th near Sakota port. The midbody of the CLARA MAERSK under tow grounded near 35°N, 126°E, during heavy weather on the 20th.

On the 20th, the 7,279-ton TRANSOCEAN RAM and the 11,086-ton CLAIRE A. TSAVLIRIS collided in fog about 25 mi west of San Diego. The dredger SEALANE being towed to breakers listed heavily on the 25th in heavy weather.

Weather problems by the CHARLES LYKES, WORLD FUJI, DUNAV, ONOMICHI MARU, GARSA TIGER, VISHVA AMITABH, SEIUN MARU, and ARTEMIS are described in the Logs.

Other Casualties--Barges from the BENJAMIN HARRISON broke tow in high winds and rough seas while unloading at Hodeidah, Yemen, on the 5th. The LYSAGHT ENTERPRISE reported damage during high winds on the 17th at Sydney. She also struck the bulkcarrier TECTUS. The bulkcarrier CAPTAIN LEMOS grounded at Dammam in strong winds on the 18th.

ROUGH LOG, JANUARY 1981--The envelope of the majority of the storm tracks this month resembled a horn of plenty with the small end near Japan and the large open end near the Alaska Peninsula. This followed the major storm paths as indicated by climatology. A major climatic path from east of Japan northward into the western Bering Sea was barely represented. Storms originating north of Hawaii quickly turned northward into the Gulf of Alaska. A few storms paralleled or crossed the North American coast.

The Aleutian Low was 985 mb near 50°N, 170°W, which was 12 mb deeper and 900 mi to the east of its climatic counterpart. The Pacific High was near normal off Baja California. This made the Aleutian Low the dominant feature of the mean-pressure chart, exerting its influence from latitude 25°N to 75°N, and between the Asian and the North American coasts. The only significant anomaly was a large negative one that covered basically the same area as the Aleutian Low. Its large central area contained three centers; minus 20 mb near Cape Romanzof, minus 19 mb near Unimak Pass, and minus 17 mb near 47°N, 150°W. The anomaly pattern was ridged over the Rocky Mountains as in the pressure and height patterns.

The upper air pattern was shifted eastward. The normal closed Low over the northern tip of Sakhalin Island was shifted to the north central Bering Sea (60°N, 180°). The upper wind flow was zonal until about 160°W, where it shifted northeastward and northward. The ridge over western North America was sharper and also shifted eastward. There were two anomalies that influenced the weather, or the weather that produced the anomalies, a large negative one over the north central ocean and a large positive one centered over the northern Canadian Plains.

Extratropical Cyclones--Monster of the Month, North Pacific--This storm formed on the east coast on Honshu as another LOW was over the Sea of Japan. The

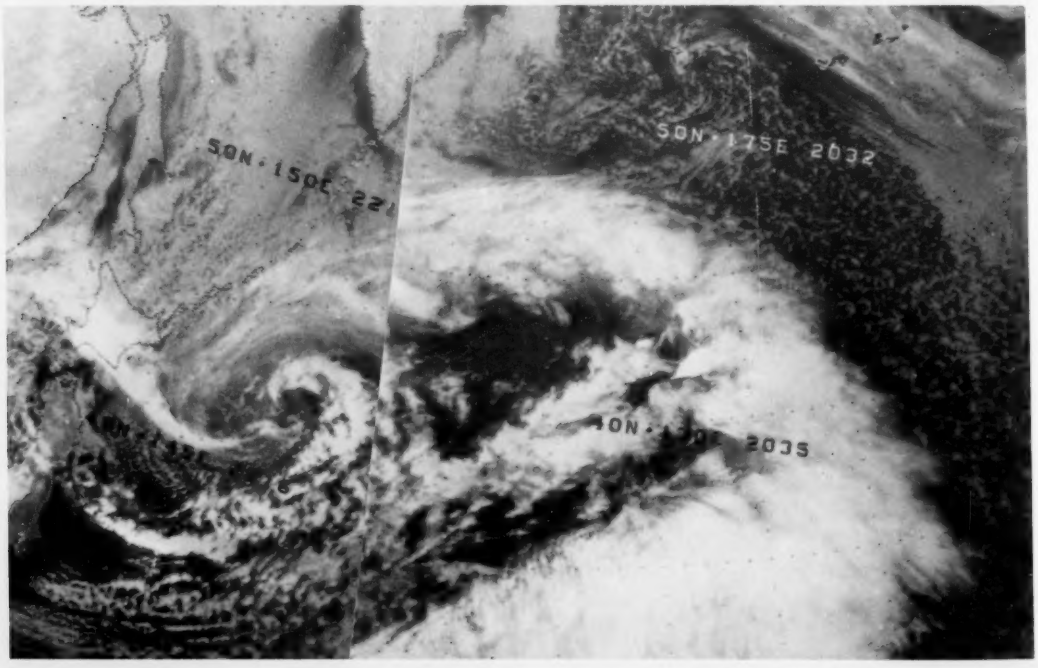


Figure 61.--The low-pressure center that became the primary storm is on the right near 43°N, 167°E. A second center was off Hokkaido, thereby increasing the pressure gradient and bringing high winds to Japan.

GOLDEN PINE sank after reporting taking water in No. 1 and 2 holds on the 2d, west of Shikoku. None of the crew of 25 were found. The storm moved rapidly eastward and by 0000 on the 4th was near 45°N, 168°E (fig. 61). The bulkcarrier ANTIPAROS with a crew of 35 and laden with 21,000 tons of iron scrap sank sometime after the 3d. She had radioed her agent that she was in difficulties in heavy seas. Her position on the 2d was 33°N, 154°E. No trace was found.

Another center was following this one and elongating the total circulation. Southeast of the LOW near the top of the ridge a ship had 33-ft swells. A ship near the cold front in the warm sector had 30-ft swells. Another in the northeast flow had 25-ft swells. The higher winds were 45 to 50 kn and south of the centers.

On the 5th the original LOW was moving northeastward and the second LOW swinging around the southern edge. The COLUMBIA MARU (34°N, 172°E) had 50-kn winds. Some ships along 180° between 25° and 35°N had swells up to 30 ft.

The 0000 chart of the 6th showed a large cyclonic circulation with four low centers. Cyclonic curvature extended from Asia to North America and 25°N to the Arctic Ocean. The only exceptions were where ridges from the Pacific and Asian Highs extended into the southern corners. The SANKOGRAIN in the central ocean (38°N, 180°) found 50-kn winds with only 15-ft waves. Many ships scattered throughout the westerly flow had 20-ft swells. The MIKAWA MARU (50°N, 174°E) near the original LOW had 28-ft swells. On the 6th the original LOW disappeared. The second one turned northward, then northwestward across the Bering Sea. The large cyclonic circulation continued.

This was another of the LOWs associated with the large cyclonic circulation. It developed in a trough off Honshu. At 0000 on the 6th the storm was near 38°N, 154°E. The ERIKA BOLTEN was about 550 mi southwest of the center with 50-kn winds and 25-ft waves. The MEERDRECHT (29°N, 150°E) had light winds but 26-ft swells. By the 7th a second LOW had formed west of this one as in the previous storm system. The GOLDEN ORCHID found 56-kn winds due south of this new storm. Thirty-foot waves were found by a French ship southeast of the first LOW near the cold front. On the 8th the ship had 34-ft seas. About 300 mi southwest of the original LOW a SHIP reported 33-ft waves and another 26-ft swells. There were several cases of waves over 20 ft. Two ships thousands of miles apart (149°E and 166°W) had 60-kn winds. The ZIM HONG KONG found 60-kn winds within 4 mb of the 970-mb storm on the 9th. The JAPAN ERICA had 55-kn winds and 26-ft swells 400 mi south of the center. The LOW stalled near 50°N, 173°W, on the 9th until it moved northward on the 11th and dissipated on the 12th.

Three small LOWs were drifting around the periphery of a LOW that was near Mys. Lopatka on the 11th. One of these became unstable and increased in size. On the 12th the LOW was 974 mb near 44°N, 179°W. The PRESIDENT KENNEDY and JUPITER 1 were both within a few miles of 42.5°N, 173°W, and reported winds of 45 kn with 20- and 25-ft waves on the 13th. The LOW was 960 mb near 47°N, 170°W, at the time. Three ships had 45- to 50-kn winds south of the storm on the 14th. The PRESIDENT KENNEDY was traveling eastward with the storm and had 50-kn winds with 33-ft waves on the 15th. Late that day the storm disappeared in a puff of sea spray.

The large cyclonic circulation still existed across the northern ocean but was not as strong and beginning to break down in the west. On the 13th a small depression was found near 37°N, 148°W. At 0000 on the 14th the 969-mb storm was moving northward. In the southwest sector the CGC IRONWOOD was sailing into gales with 30-ft swell waves. Not far away a German ship had 26-ft swells.

The pressure gradient had piled up against the coastal mountains from California to Alaska. The SHINKO MARU (46°N, 138°W) had 57-kn southerly winds. The ALEUTIAN DEVELOPER (54°N, 139°W) had 45-kn winds from the south. The isobars ran nearly directly north-south. The pressure at the two ships only disagreed by 1.7 mb. At 1800 the MOBIL MERIDIAN (53°N, 132°W) reported 78-kn winds stirring up waves of 33 ft (fig. 62). There were various gale reports on the 15th as the front crowded closer to shore. The LOW moved over Anchorage as it traveled northwestward.

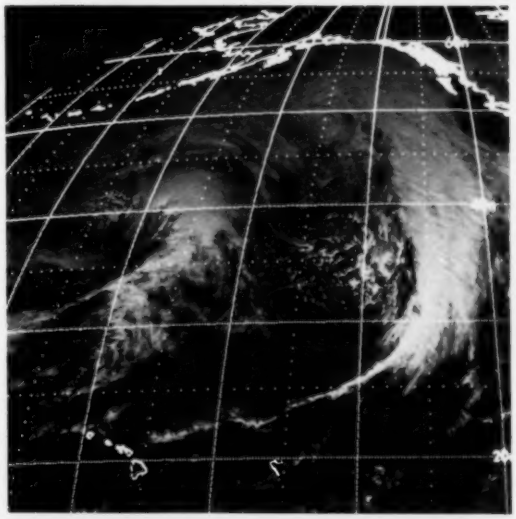


Figure 62.--The circulation center has raced northward to near 50°N, 145°W. The heavy weather is under the frontal cloud shield. The circulation of the previous storm is near 40°N, 160°W.

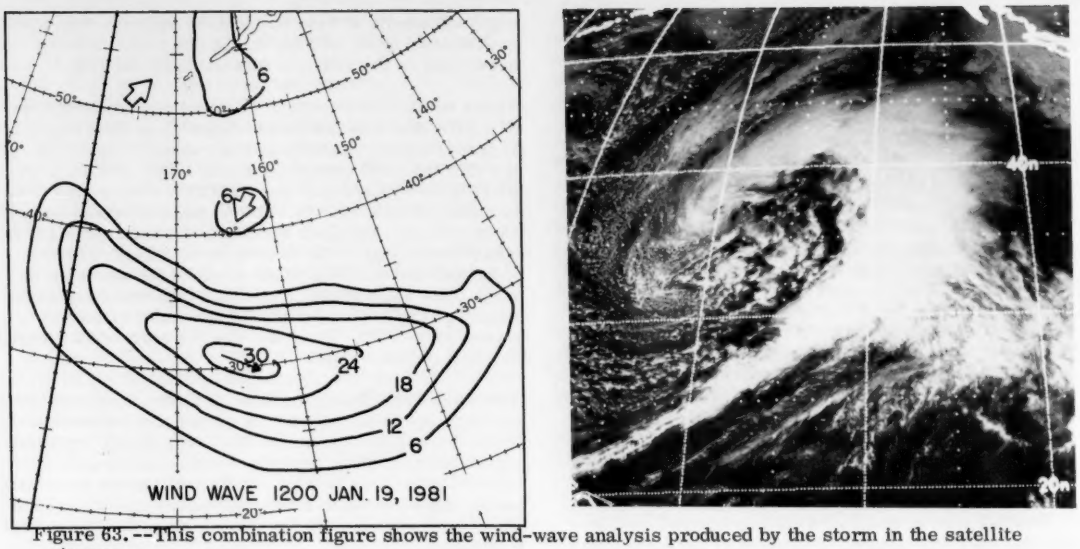


Figure 63.--This combination figure shows the wind-wave analysis produced by the storm in the satellite image.

A LOW came out of Asia and was over the Korea Strait at 0000 on the 15th. It traveled eastward bringing only gales to those in its path. On the 18th the AMERICAN LIBERTY (38°N, 169°E) had 45-kn gales about 2° latitude south of the center. Nearby the BLUE HAWK was having 23-ft waves.

On the 19th there was a switch of centers as another was found to the east on the 0000 analysis. At this time the severe weather was high waves of 20 to 30 ft in the southwest sector about 600 mi from the center (fig. 63). At 1800 the SINALOA and the BIRCHBANK both reported 60-kn winds near 28°N, 162°W. The former reported 46-ft swell waves, and the latter 26 ft. At 0000 on the 20th the SINALOA still howled about 39-ft swells. The ANTE TOPIC (41°N, 139°W) east-northeast of the 954-mb storm (39°N, 146°W) had 60-kn winds and 41-ft waves. The MAUI (29°N, 144°W) found 65-kn winds at 0600 with 25-ft waves. Waves of 20 to 30 ft were being reported in all quadrants except the northwest. At 1200 a SHIP at 29°N, 144°W, radioed a report of 49-ft swell waves.

A listing of wind reports of 45 kn or greater showed 15 reports around the storm. Four were of 60 kn, two in northwest flow and two in southeast flow. The CGC POTOMAC (46°N, 130°W) was one of the ships with 60-kn winds, but the swell waves were coded as ship-breaking 62 ft. The VRCS (51°N, 146°W) appeared to be the closest to the storm center with a pressure of 966 mb (storm center 956 mb) and 48-kn northerly winds and 49-ft waves. The AMERICA SUN, ARCO JUNEAU, and MOBIL ARCTIC, in the vicinity of 52°N, 136°W, all had swell waves of 38 to 43 ft. On the 22d the PACSTAR (50°N, 147°W) called the winds 75 kn and the waves 33 ft. Others were reporting around 50 kn and 25- to 30-ft waves. Later in the day the storm broke up rapidly.

This storm was a series of LOWs. The instigator of the whole thing was an insignificant 1003-mb center first found on the 1200 chart of the 19th east of the Tsugaru Strait. By 0000 on the 22d the storm was 966 mb near 46°N, 175°W. In the meantime another small LOW had tracked eastward from Hokkaido. There was strong northwesterly flow between this LOW and a 1057-mb HIGH over central Asia. The PIONEER No. 1 found 50 kn off the east coast of Honshu. South of the primary LOW there were some 20- to 25-ft waves.

By 0000 on the 23d the storm had deepened further to 956 mb (fig. 64). Four ships had winds between 45 and 50 kn. The AMAZON MARU (47°N, 170°W) about 200 mi south of the storm's center had 26-ft waves.

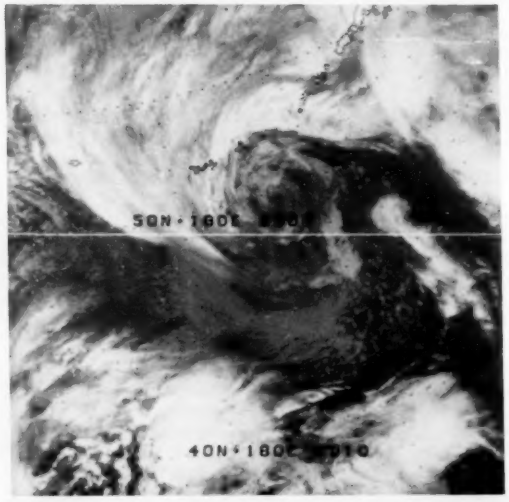


Figure 64.--A typical mature cyclone, where the front has occluded and moved away from the center to the eastern edge of the circulation.

At 0300 the NATALIE BOLTEN was about 300 mi south of the second LOW with 64-kn winds and 43-ft swell waves. Later in the day another LOW formed east of the second LOW and sped northeastward. By the 24th the first two LOWs were weakening and new circulation was 960 mb. There were 20- to 25-ft waves in the westerly flow south of the centers. At 1800 the SEA-LAND DEVELOPER was off Queen Charlotte Sound with 54-kn winds from the southeast. She was sailing northwestward toward the storm and winds near 50 kn continued into the 26th. The storm moved up the west coast of Alaska into the Bering Strait.

Casualties--The following vessels encountered heavy weather and suffered damage or requested surveys for damage this month. They were the AEGIS PRACTIC, AQUACHARM, CAPTAIN VENIAMIS, EASTPORT, GOLDEN KIMISIS, GOLDEN MIRANDA, HOPECLIPPER, and SEA TIGER.

The GOLDEN PINE sank off Shikoku after radioing that No. 1 and 2 holds were flooded in rough weather. Search craft found an oil slick, lifeboat, and rafts, but none of the crew of 25. The ANTI PAROS, with a crew of 35, sank off Japan on the 3d or 4th. She radioed that she was in trouble due to heavy seas. No trace was found.

The ferry KLAHOWYA and bulkcarrier SANKO-GRAIN collided in fog in Elliot Bay, near Seattle on the 13th. On the 15th the SEINE MARU collided with the COOP GRAIN in the same bay in fog.

Other Casualties--The STAR CENTAURUS arrived Australia with heavy weather damage. The tug BELLARINE, Westernport to Melbourne, encountered heavy weather on the 21st with damage. The NANCOCK, carrying supplies to Australia's Antarctic bases, damaged her rudder in an ice pack. The NAND KOYAL, Bombay for Colombo, arrived on the 13th with weather damage. The AL MUREJAN was driven ashore in high winds at Sharjah.

Marine Weather Diary

NORTH ATLANTIC, APRIL

WEATHER. A noticeable reduction in the frequency and intensity of winter-type LOWS takes place this month. The Icelandic Low has filled to 1007 mb and is centered near 60°N, 35°W. The Azores High has become more of a blocking ridge as it becomes oriented in a more southwest-northeast direction at 1021 mb near 30°N, 30°W. The primary area of storm formation is off the North American coast from the Carolinas to Newfoundland. The major storm track is from Cape Hatteras to Iceland. The mean 0°C isotherm extends from Trinity Bay to Frederikshab Greenland. Along latitude 40°N the mean temperature ranges from 8°C off New Jersey to near 16°C at 35°W to 14°C off Lisbon. Over the Mediterranean the mean temperature ranges from 14°C to 18°C. The extreme 0°C isotherm can reach as far south as Cape Cod, south of Iceland to northern Denmark. The mean sea-surface temperature along latitude 40°N is 7°C south of Long Island to 16°C at 40°W to 15°C off Portugal.

WINDS. The prevailing winds north of 30°N are from the west and southwest except for northerly winds west and east of Greenland. South of 30°N, the prevailing winds are east and northeast except over the water just east of Florida where southerly winds are also frequent. The average wind speeds north of 35°N are force 3 to 5 except for an area running south of Kap Farvel to 45°N, where they average force 4 to 6. South of 35°N, the average force is 2 to 4.

GALES. The frequency of gales has decreased significantly over the middle and northern latitudes. The main region of gale activity, 10 percent or more, is oriented along the southeastern coast of Greenland extending some 400 to 600 mi seaward. The Gulf of Lions and two areas (about 6-degrees square) centered near 50°N, 40°W and 58°N, 18°W are the only other areas having gale frequencies of 10 percent or more.

EXTRATROPICAL CYCLONES. The primary area of cyclogenesis extends along the U.S. coast from Georgia to Maine and then northeastward along a band some 600 to 800 mi wide to a point near 52°N, 30°W. Other major areas of cyclonic development are in the Bay of Biscay and the northwestern Mediterranean Sea north of a line from Barcelona to central Yugoslavia. Another small area for cyclogenesis is along the northeastern coast of Algeria. Lows following the primary track that crosses the Great Lakes generally move northeast towards the Gulf of St. Lawrence where they either turn north into the Davis Strait or into the Central Atlantic. Another primary track leads from a point some 300 mi east of Chesapeake Bay towards Iceland, while one from northwestern Canada along with a secondary track from the Great Lakes region extends into Hudson Bay. A secondary track from the central Atlantic crosses the British Isles into eastern Europe as others cross out of the Bay of Biscay into the northern Adriatic and from Algeria into the southern Adriatic.

TROPICAL CYCLONES. For the period of record 1871 to 1980, April is the only month in which no tropical storm activity has been observed for the North Atlantic.

WAVE HEIGHTS. Wave heights of at least 12 ft are found more than 10 percent of the time along a major axis that leads from some 300 mi off Cape Hatteras northeastward through the Norwegian Sea and along a minor axis that extends from southern Greenland to northwestern Spain. Frequencies of 30 percent extend from 40°N to 62°N between Ireland and a point to the southeast of Kap Farvel.

VISIBILITY. The general area of poor visibility (less than 2 mi) has not changed much from March. The 10 percent line runs southeast of the Bay of Fundy turning northeastward to the Denmark Strait and Barents Sea. The frequency of visibilities less than 2 mi has increased over Newfoundland as the 20 percent frequency area doubled in size. It completely surrounds the island except for a small area off the south coast and extends about 300 mi seaward off the northeast coast. Poor visibilities have decreased over the Baltic Sea and Norwegian Sea but increased over the North Sea and Irish Sea. The Mediterranean Sea continues to maintain good visibilities as in prior months.

NORTH PACIFIC, APRIL

WEATHER. As temperatures increase, the Aleutian Low continues to fill. It has a poorly defined central pressure of around 1009 mb elongated over the region from the Kamchatka Peninsula to the easternmost Gulf of Alaska with a secondary cell over the Sea of Okhotsk. South of the Aleutian Low, the North Pacific High is oriented in a east-west direction with its axis along the 35th parallel. It has elongated and expanded westward into Asiatic waters while shifting its mean central position northwestward to near 35°N, 150°W. Its mean central pressure remains at just over 1023 mb. Over the western portion of the Pacific, air temperatures have increased by 2°C to 6°C from March, while over the eastern portion increases of only 1°C to 2°C have taken place. Mean air temperatures range from less than -18°C in the Chukchi Sea to over 28°C in the southwest Pacific between the equator and the northern Philippines. The 0°C isotherm extends from

Mys Popatka to Bristol Bay, the same as the sea-surface temperature. At 40°N, means range from 8°C off Asia to just over 12°C at 132°W to just under 12°C off the California coast. Ninety-eight percent of the temperatures fall between -32°C and 4°C at 60°N to 70°N, between -4°C and 20°C at 35°N to 45°N, and between 24°C and 34°C at 0° to 10°N. Along latitude 40°N the sea-surface temperature ranges from 8°C in the Sea of Japan to 12°C off California.

WINDS. The prevailing winds between 35°N and 55°N are from the western quadrant (225° to 315°) while south of 35°N they are northeasterly and easterly. Wind speeds across most of the North Pacific average force 3 to 5 with slightly higher winds south of the western edge of the Aleutian chain averaging force 4 to 6.

GALES. The frequency of gales (force 8 or greater) has decreased substantially from the colder months. Frequencies of 5 percent or greater extend from east-central Japan along the Kuril Islands to the southern tip of the Kamchatka Peninsula then eastward into the Gulf of Alaska. The highest frequencies, 10 percent or more, are observed south of the western tip of the Aleutian chain.

EXTRATROPICAL CYCLONES. The primary area of cyclogenesis extends over 1,000 mi eastward from Japan. The primary tracks run from Japan to the northwestern side of the Aleutian chain into Bristol Bay, and from south of the Fox Islands to near 53°N, 150°W and then branching into Alaska and southwestern Canada, from Manchuria into the Sea of Okhotsk, and Sakhalin Island across the Kuril Islands.

TROPICAL CYCLONES. The non-occurrence of tropical storm activity in the eastern North Pacific for the period of record (1949-1980), indicates how unlikely an April encounter would be. Activity has increased slightly in the western North Pacific over the previous 3 mo. For an average 10-yr period, one can expect 9 storms to reach tropical storm strength ($\geq$ 34 kts) and of these 7 should reach typhoon strength ($\geq$ 64 kts).

WAVE HEIGHTS. In general, most areas between 30°N and 60°N and from Japan to North America experience wave heights of 12 ft or higher 10 percent or more of the time. Frequencies increase to a maximum of 30 percent along the southwestern edge of the Aleutian Chain.

VISIBILITIES. Visibilities improve slightly during April, as the highest frequencies of poor visibilities (less than 2 mi) is 20 percent. These frequencies appear in the eastern Sea of Okhotsk, south of the Kamchatka Peninsula along the eastern side of the Kuril Islands and over most of the Bering Sea. Frequencies of 10 percent or more are observed along most coastal areas of Asia north of 20°N, and north of 40°N across the western three quarters of the Pacific.

NORTH ATLANTIC, MAY

WEATHER. The Icelandic Low centered east of Kap Farvel near 58°N, 32°W has filled to a mean central pressure of 1010 mb. The Azores High has built slightly to a central pressure of 1023 mb near 32°N, 35°W. As the mean pressure over the North Atlantic increases, the north-south pressure gradient decreases. The associated weather continues to moderate in the mid-latitudes. A marked increase in mean air temperatures is noted for the middle and northern latitudes. The 0°C mean air temperature isotherm now extends northward through the Davis Strait from Frobisher Bay. The mean air temperature along latitude 40°N ranges from 12°C south of Nantucket to 17°C at 35°W to 16°C off Portugal. The sea-surface temperature has not changed as fast. Along latitude 40°N it ranges from 10°C south of Long Island to 15°C off Portugal rising to about 17°C at longitude 40°W.

WINDS. Winds over the greater part of the Atlantic between 40°N and 55°N are generally westerly while north of 55°N they are mainly northerly to easterly. Between 30°N and 40°N the prevailing winds are southwesterly over the western half and northerly over the eastern half. South of 30°N the winds are predominantly easterlies. Average wind speeds north of 40°N are force 3 to 5 while south of 40°N they are force 2 to 4. Over Mediterranean waters, northwesterly winds of force 2 to 4 are most common while over the Gulf of Mexico and the Caribbean the prevailing easterlies average force 2 to 4 over the Gulf and force 3 to 5 over the Caribbean.

GALES. Winds of force 8 or higher are rare south of 40°N, and their frequency and duration in higher latitudes have decreased from the preceding months. The area with the highest frequency of occurrence, 10 percent or more, is located off the southern tip of Greenland. The frequency of gales is near 5 percent over most of the central Atlantic north of 40°N, and over the Gulf of Lions in the Mediterranean Sea.

EXTRATROPICAL CYCLONES. LOWS continue to develop frequently from off the Carolina coast northeastward to Newfoundland. Other major areas of cyclonic development include the eastern Bay of Biscay, the region between Algeria and Sardinia, and a small area centered near 60°N, 27°W. Primary tracks leading from the Great Lakes and Delaware Bay head northeast towards Newfoundland where they spread across the northern latitudes of the North Atlantic. One secondary storm track leads from the Azores northeastward to waters off northwest Spain where it divides heading north towards

the British Isles and east across the Bay of Biscay into the northwestern Mediterranean Sea. Another secondary track crosses central Italy and the northern Adriatic into eastern Europe.

TROPICAL CYCLONES. The frequency of tropical cyclones begins to increase slightly during May, but they are still infrequent. For the period 1871-1980, 11 tropical cyclones have been reported, of which three attained hurricane force.

WAVE HEIGHTS. Wave heights of 12 ft or more are confined mainly to the mid-ocean areas with the region observing frequencies of 10 percent or more extending from near 38°N, 62°W to southern Greenland to 65°N, 0°W and to just northwest of the coast of Spain. Frequencies of 20 percent extend from Iceland south to 42°N and between Greenland and the waters west of Ireland.

VISIBILITY. The frequency of visibilities less than 2 mi increases over the Grand Banks from the previous month, while the rest of the North Atlantic experiences little change. Waters to the north of Iceland, between Delaware Bay and southern Greenland, and most of the North Sea, Irish Sea, and English Channel report poor visibilities of less than 2 mi 10 percent or more of the time. The highest frequency of poor visibilities, 30 percent, occurs over the Grand Banks with the surrounding area from Georges Bank to the southwestern Labrador Sea reporting 20 percent.

NORTH PACIFIC, MAY

WEATHER. With summer nearing, the Aleutian Low becomes rather ill-defined even though the pressure over the Bering Sea remains relatively low. The lowest pressure is 1007 mb over Tatar Strait. The dominate feature is the Pacific Subtropical High which extends from the North American to the Asian Continent with ridging as far north as Alaska. Its mean central pressure still remains just over 1023 mb which is now centered near 35°N, 140°W. As the sun moves north the air temperature range decreases substantially between the equator and the pole. Temperatures south of 20°N increase little, but north of 60°N they increase by 6° to 12°C. Mean temperatures range from -6°C in the Chukchi Sea to over 28°C near the equator. The freezing isotherm has retreated to 64°N along with the sea temperature. Approximately ninety-eight percent of the observations in the Chukchi Sea fall between -20°C and 4°C, at 40°N between 4°C and 20°C, and south of 20°N between 20°C and 32°C. Mean temperatures along the 40th parallel are nearly isothermal with only a one degree range from 12°C in the western Pacific to 13°C in the eastern Pacific. The sea-surface temperature parallels the air temperature.

WINDS. The mean wind speeds have continued to decrease from the winter months. The strongest average winds, force 4, prevail from southern Japan to the Gulf of Alaska, off the California coast, and in the areas associated with the persistent northeasterly and easterly trades. The remainder of the Pacific averages force 2 to 3. Northeasterly winds prevail south of 30°N and over the northern portion of the Bering Sea and Chukchi Sea. Southwesterly and westerly winds prevail over the remainder of the Pacific except along the west coast of the U.S. where they are northwesterly and over the Asian waters where they are southerly.

GALES. During May there are few reports of gale force winds ($\geq$ 34 kts). Three small areas report frequencies of 5 percent. One area is located south of the western portion of the Aleutian chain centered near 49°N, 178°E, another is centered near 48°N, 167°W, and a third along the Oregon and northern California coasts.

EXTRATROPICAL CYCLONES. The principal area of cyclogenesis has shifted westward, extending from the Sea of Japan to near 45°N, 163°E. A smaller second area has appeared south of the central Aleutian Islands, centered near 45°N, 175°W. The primary tracks run from southeastern Japan to western Canada with a track near 42°N, 162°E branching into the southwestern Bering Sea and one near 52°N, 155°W branching into southern Alaska. A secondary track moves northeastward across northern Japan and the southern edge of the Kuril Islands.

TROPICAL CYCLONES. By May, sea temperatures are beginning to increase enough in the eastern North Pacific to produce some infrequent tropical cyclone activity. During an average 10-yr period in the eastern North Pacific one can expect 3 tropical cyclones of force 8 or greater, with most obtaining hurricane strength ($\geq$ 64 kts). On the average for a comparable time in the western North Pacific, one can expect 13 tropical cyclones to reach force 8 with 9 of these reaching typhoon strength ($\geq$ 64 kts).

WAVE HEIGHTS. By May, wave heights of 12 ft or higher have decreased significantly from the winter months. Frequencies of just more than 10 percent are the highest observed. Regions where these frequencies occur are off the northern coast of California, southwest of the Pribilof Islands, and between the Kuril Islands and the Gulf of Alaska between 40°N and 55°N.

VISIBILITIES. Increased occurrences of visibilities of less than 2 mi have appeared over the northwest Pacific. Frequencies of 10 percent or more lie north of a line that extends from the southern edge of the East China Sea across central Japan into the Gulf of

Alaska and along the western coast of Alaska. An area of twenty percent frequencies lies off the southwestern tip of Korea in the Yellow Sea and runs from northern Japan into the Sea of Okhotsk and covers most of the Bering Sea. The highest frequencies, 30 percent, occur over the central portion of the Sea of Okhotsk and Kuril Islands and along the northeastern coast of the Kamchatka Peninsula.

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